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Final Environmental Assessment for the Renewal of SNM-1107 Columbia Fuel Fabrication Facility in Richland County, South Carolina

Westinghouse Electric Company, LLC
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ACRONYMS AND ABBREVIATIONS

AADT	annual average daily traffic
ac	acre(s)
ADU	ammonium diuranate
AIT	augmented inspection team
ALARA	as low as is reasonably achievable
AS/SVE	air sparging/soil vapor extraction
BRA	Baseline Risk Assessment
µCi	microcurie(s)
CAL	confirmatory action letter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of *Federal Regulations*
cfs	cubic feet per second
CFFF	Columbia Fuel Fabrication Facility
CO_2eq	carbon dioxide equivalent
COPC	chemicals of potential concern
d	day
DFP	decommissioning funding plan
DOT	U.S. Department of Transportation
DP	decommissioning plan
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERPG	emergency response planning guideline
ESA	Endangered Species Act
FS	feasibility study
ft	foot(feet)
ft^3	cubic foot(feet)
FWS	U.S. Fish and Wildlife Service
µg	microgram(s)
GCRP	U.S. Global Change Research Program
GHG	greenhouse gas

gpd	gallon(s) per day
ha	hectare(s)
HEPA	high-efficiency particulate air
HF	hydrogen fluoride
HPDE	high density polyethylene
IROFSs	items relied on for safety
ISA	integrated safety analysis
ISG	interim staff guidance
kg	kilogram(s)
km	kilometer(s)
LLW	low-level radioactive waste
m	meter(s)
m^3	cubic meter(s)
MBTA	Migratory Bird Treaty Act
mCi	millicurie(s)
mg	milligram(s)
Mgd	million gallons per day
mi	mile(s)
mrem	millirem
MCL	Maximum Contaminant Level
MSL	mean sea level
mSv	millisievert(s)
MT	metric ton(s)
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NMFS	National Marine Fisheries Service
NMSS	Office of Nuclear Material Safety and Safeguards
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
PCE	tetrachloroethene
pCi	picocurie(s)
PSD	prevention of significant deterioration

RAI	Request for Additional Information
RI	Remedial Investigation
S	State Highway
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCDOT	South Carolina Department of Transportation
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SNM	Special Nuclear Material(s)
sVOC	semi-volatile organic compounds
T	ton(s)
Tc-99	technicium-99
TCE	trichloroethene
TSS	total suspended solids
U	uranium
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
UF_6	uranium hexafluoride
UO_2	uranium dioxide
UO_2F_2	uranyl fluoride
URRS	Uranium Recycling and Recovery Services
VCC	voluntary cleanup contract
VOC	volatile organic compound
WEC	Westinghouse Electric Company, LLC
WWTP	wastewater treatment plant
yd	yard(s)
yr	year(s)

1. INTRODUCTION

The Westinghouse Electric Company, LLC's (WEC) Columbia Fuel Fabrication Facility (CFFF) located near Columbia, South Carolina, has been operating since 1969 and fabricates low-enriched uranium fuel assemblies for commercial nuclear power reactors. On July 31, 2014, WEC (2014a) submitted a timely application to the U.S. Nuclear Regulatory Commission (NRC) to renew its Special Nuclear Materials (SNM) License SNM–1107. WEC submitted a revised application on December 17, 2014, that the NRC accepted for review (WEC 2014b). The NRC issued several requests for additional information (RAIs) related to the environmental review (NRC 2016a, b; 2017g). WEC submitted responses to the RAIs (WEC 2017d, 2018a) as well as an updated license renewal application (WEC 2018a) and an update to the environmental report (WEC 2018b). 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.

The purpose of this environmental assessment (EA) is to assess the potential environmental impacts of the proposed license renewal. The NRC staff has prepared this EA following NRC regulations at Title 10 of the *Code of Federal Regulations* (CFR) Part 51 that implement the National Environmental Policy Act of 1969 (NEPA), and pursuant to guidance in NUREG–1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NRC 2003).

The NRC staff is also performing a detailed safety analysis of the CFFF license renewal to assess compliance with 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material." The NRC staff's safety analysis will be documented in a separate Safety Evaluation Report (SER). The NRC decision 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 this EA.

1.1 Proposed Action

The proposed action, as requested by WEC, is the continued operation of the CFFF for an additional 40 years. Current operations at CFFF include receiving 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). WEC's SNM-1107 license was renewed in 2007 for 20 years and will expire in 2027. The 40-year renewal, if granted, would extend WEC's license for 40 years from the date the NRC approves the renewal.

1.2 Purpose of and Need for the Proposed Action

The CFFF is one of three facilities in the United States that fabricate fuel assemblies for commercial nuclear power plants. WEC's proposed license renewal would allow the CFFF to continue to be a source of nuclear fuel for commercial nuclear power plants.

1.3 Alternatives to the Proposed Action

This section describes the alternatives to the proposed action, including the no-action alternative.

1.3.1 No-Action Alternative

Under the no-action alternative, the NRC would deny WEC's request to renew CFFF's license. As a result, the CFFF would continue to operate under its current license until it expires on September 30, 2027. The NRC staff previously evaluated the environmental impacts of WEC continuing to operate the CFFF until September 2027 when it approved WEC's license renewal in 2007. The NRC staff concluded in the 2007 EA that the continued operation of the CFFF site would not result in a significant impact on the environment (NRC 2007).

The impacts of the no-action alternative would be similar to those of the proposed action, as discussed in Section 4 of this EA, except the impacts of the no-action alternative would occur only until 2027 and decommissioning, including any site remediation, would occur sooner. Therefore, because the impacts of the no-action alternative would be similar to those of the proposed action, this alternative will not be discussed further in this EA.

1.3.2 Alternative 1 – License Renewal for Less than 40 Years

Another alternative considered but eliminated from further review is for the NRC to grant WEC another license renewal, not for the requested 40 years but some other shorter timeframe (i.e., 10, 20, 30 years). The environmental impacts for continued operations for a timeframe less than 40 years would be the same or less than those evaluated in this EA for 40 years of continued operation.

The timing of decommissioning would be different if license renewal was granted for less than 40 years but the types of impacts from decommissioning would be similar. Therefore, the environmental impacts of this alternative will not be discussed further because they would be similar to the impacts of continued operation for an additional 40 years as discussed in Section 4 of this EA.

1.4 Scope of Environmental Analysis

This EA evaluates the environmental impacts of continuing the currently licensed operations through license renewal, considering many aspects of the proposed action, the affected environment, and the interaction between the two, which have been addressed in past NRC environmental review documents. This EA therefore incorporates by reference information from EAs prepared for the previous license renewals, where noted. This EA focuses on new and significant information since 2007 and reflects changes in the affected environment and recent operating history.

In preparing this EA, the NRC staff considered various documents and sources of information, including the following:

- WEC's license renewal application submittals including an Environmental Report (ER)
- WEC's responses to NRC RAIs
- previous NRC EAs for CFFF operations
- information gathered from the NRC site visits
- NRC inspection reports
- other reports (e.g., WEC's effluent monitoring reports).

In its ER, WEC (2014b) also requested an increase in CFFF's possession limit for uranium-235 (U-235) and an expansion of the UF_6 Pad Annex, also known as the "auxiliary UF_6 storage pad." The NRC approved the physical expansion of the storage pad by License Amendment No.18 (NRC 2015a). Therefore, that request and approval will not be evaluated in this EA.

WEC (2014b) also requested, in the ER, an increase in its calcium fluoride release limits from 30 picocuries per gram (pCi/g) to 60 pCi/g. However, in 2017, WEC (2017a) withdrew its request and will maintain the calcium fluoride limits at the currently approved limit of 30 pCi/g. Therefore, a change in calcium fluoride limits is not evaluated in this EA because it is no longer being requested by WEC.

1.5 Previous Environmental Analysis

Because the CFFF was licensed by the Atomic Energy Commission in 1969, prior to the implementation of NEPA, no environmental review was done for the construction and initial operation of CFFF. However, since 1969, multiple license renewals for the continued operation of CFFF have been evaluated by the NRC. In 1977, the NRC prepared an Environmental Impact Assessment[1] to consider the environmental impacts of operations at a capacity of 400 metric tons per year (MT/yr) of uranium and projected impacts of future expansion of up to a capacity of 1,600 MT/yr of uranium (NRC 1977). In 1985, the NRC completed an EA for the license renewal of SNM-1107 (NRC 1985). The NRC completed another EA in 1995 for a 10-year renewal of SNM-1107 (NRC 1995). In 2007, the NRC prepared another EA for renewal of the CFFF license that addressed the potential environmental impacts of 20 more years of continued operation. The 2007 EA concluded that the renewal of the CFFF license would not result in a significant impact on the environment, that no Environmental Impact Statement (EIS) was warranted, and that a Finding of No Significant Impact was appropriate in accordance with 10 CFR 51.31 (NRC 2007).

[1] Environmental Impact Assessments were the NRC's predecessor to EAs.

2. GENERAL DESCRIPTION OF CFFF SITE AND OPERATIONS

This section describes the existing CFFF and its operations that would continue during the 40-year license renewal period if the NRC grants the license renewal. The CFFF is a Category III fuel cycle facility[2] that fabricates low-enriched uranium for use at light water commercial power reactors. The CFFF has been in operation since 1969.

2.1 Site Location and Layout

The CFFF site occupies 469 hectares (ha) (1,158 acres [ac]) of semi-rural land in Richland County, South Carolina, approximately 13 kilometers (km) (8 miles [mi]) southeast of the City of Columbia. Figure 2-1 provides the general location of the CFFF site and Figure 2-2 shows the site boundary. Approximately 24 ha (60 ac) of the property area are used for facility operations and support activities. The remaining property is mostly undeveloped. The CFFF is bounded by South Carolina highway (SC) 48 (Bluff Road) to the north and private property owners in all other directions. The CFFF site lies within the flood basin of the Congaree River, which flows approximately 6 km (4 mi) southwest of the main plant (NRC 2007).

2.2 Facility Operations

A description of the operations at CFFF was provided in Section 1.3 of the 2007 EA. A summary is provided here, highlighting process changes made since 2007.

WEC fabricates nuclear fuel assemblies containing low-enriched uranium oxide fuel for use in commercial light water nuclear power reactors. WEC also produces other fuel-related products such as control rods and mechanical components. The primary facilities consist of a main fuel fabrication plant, wastewater treatment plant (WWTP) and lagoons, raw material storage buildings, and office space.

[2] The NRC classifies special nuclear materials and the facilities that possess them into three categories based upon the materials' potential for use in nuclear weapons, or their "strategic significance." The three categories are Category I, high strategic significance; Category II, moderate strategic significance; and Category III, low strategic significance. The NRC's physical security requirements differ by category; Category I facilities are subject to more stringent requirements than Category III facilities.

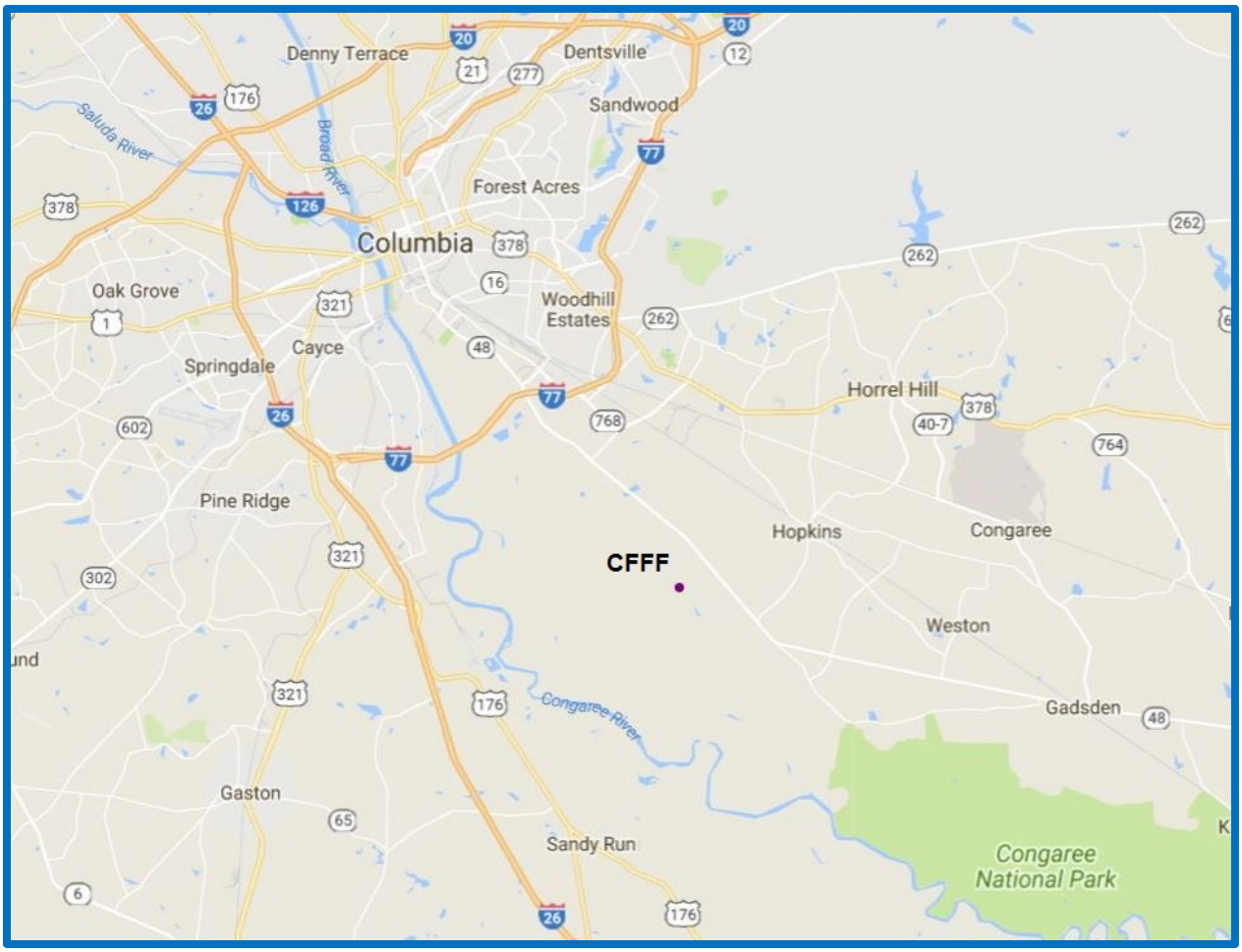

Figure 2-1. General Location of the CFFF (Source: Google)

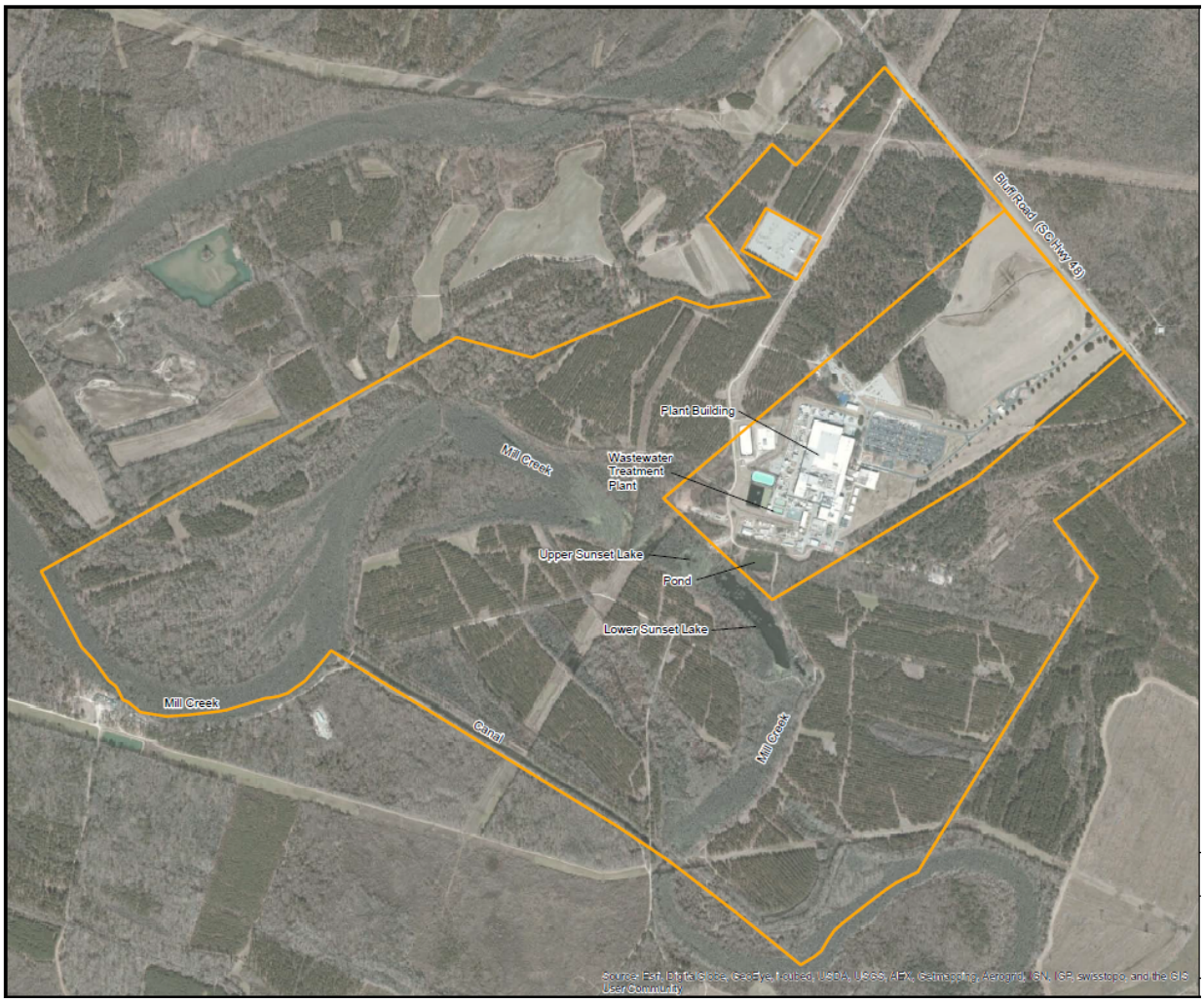

Figure 2-2. CFFF Property Boundary (WEC 2014b)

The production of nuclear fuel assemblies (see Figure 2-3) starts with the chemical conversion of UF_6 into UO_2; at the CFFF, this is done via the ammonium diuranate (ADU) process, which uses water and ammonium hydroxide. In 2011, WEC replaced the use of anhydrous ammonia with aqueous ammonium hydroxide (WEC 2014b). The UO_2 is processed and pressed into fuel pellets, heated to form a ceramic material, and processed through a grinding operation. These pellets are loaded and sealed into metal fuel rods. The rods are assembled into bundles that form the nuclear fuel assemblies.

Other facilities and processes that support the ADU chemical conversion process and pellet fabrication include oxidation of recycled fuel pellets, cylinder recertification, cylinder washing, respirator cleaning, incineration, solvent extraction, waste treatment, welding, metal fabrication, quality control testing, and shipping container painting.

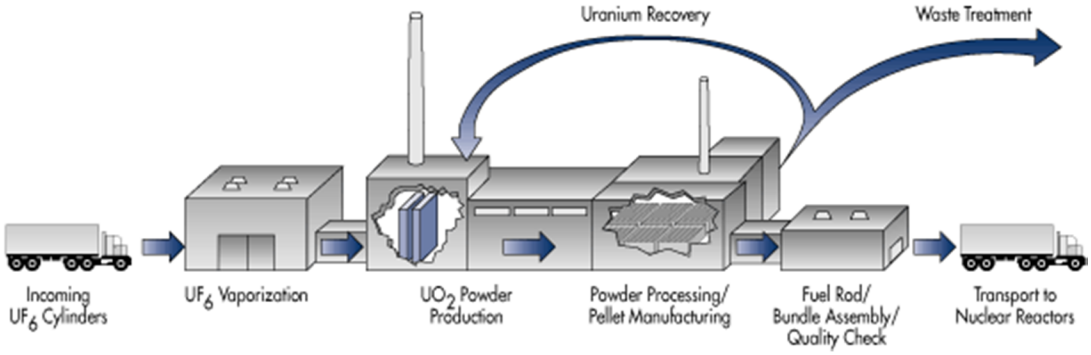

Figure 2-3. Typical Light Water Reactor Fuel Fabrication Facility

The completed assemblies are shipped in NRC-approved containers to WEC's customers for use at nuclear power plants. The shipments of nuclear materials from CFFF are governed by the NRC, the U.S. Department of Transportation (DOT), and State of South Carolina regulations.

2.2.1 Changes since 2007 License Renewal

The CFFF license has been amended multiple times, mainly to reflect administrative changes (e.g., change in management or notification procedures). The license is currently on Amendment 19 (NRC 2016c).

WEC provides annual Facility Change Reports, per 10 CFR 70.72, to the NRC about facility changes that do not require NRC approval (e.g., WEC 2017b). Some of the substantial changes that have the potential to affect the environment and have occurred since the 2007 license renewal are as follows. WEC has increased its storage limits for UF_6 cylinders by building a concrete storage pad on previously disturbed land. WEC no longer uses anhydrous ammonia in its ADU process. Due to ground-water contamination, WEC replaced the liners of four WWTP lagoons. The new liners for the West-I, West-II, South, and North lagoons are now 80-Mil HPDE (high-density polyethylene) and were replaced between 2008 and 2012. The East lagoon still has its 36-Mil Hypalon liner and WEC has no plans to replace it (NRC 2017a). The sixth lagoon, the sanitary lagoon, is unlined. A pipe leak discovered in 2011 released an unknown amount of uranium into the subsurface. The pipe leak is discussed in more detail in Section 3.2.

2.3 Waste and Effluent Management

Operations at CFFF generate gaseous and liquid effluents and solid waste. This section briefly describes the various waste streams and how WEC manages them.

2.3.1 Gaseous Effluents

Under the proposed license renewal, operations at CFFF would continue to generate gaseous effluents. These effluents would come mainly from the process stacks, equipment, and from fugitive dust. There are 47 stacks—typically short stacks or roof vents that release gaseous effluents into the air. The emissions primarily contain uranium, ammonia, and fluorides.

Table 2-1 provides the annual average release rates for the three constituents. The emissions are normally treated and sampled prior to release to the environment. High-efficiency particulate air (HEPA) filters and scrubbers are commonly used pollution control equipment employed at CFFF (WEC 2014b). Oil-fired boilers, gas-fired calciners, and diesel generators are operated and generate air emissions.

Table 2-1. Average Annual Release Rate (Source WEC 2014b)

Constituent	Average Release Rates
Uranium	470 uCi/yr
Ammonia	41 kg/d (90 lb/d)
Fluorides	*de minimis*

WEC has an air permit (No. 1900-0050) from South Carolina Department of Health and Environmental Control (SCDHEC). The permit does not require direct monitoring for nonradiological pollutants, but does allow WEC to provide modeled emission rates that SCDHEC uses to determine compliance with South Carolina air-quality control regulations (Regulations 61-62) (WEC 2014b).

2.3.2 Liquid Effluents

Operations at CFFF generate two liquid effluent streams: process wastes and sanitary wastes. 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 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. The other process stream is sanitary waste sewage, which is initially treated at the WWTP. The sanitary waste sewage is chlorinated and mixed with the process liquid waste (WEC 2014b).

The combined liquid waste is treated onsite at the WWTP prior to its discharge into the Congaree River. Treatment includes filtration, flocculation, lime addition, distillation, and precipitation. The treatment facility includes six lagoons—four are used for settling solids, one is for polishing sanitary waste, and one is for extra capacity (WEC 2014b).

The main constituents of the 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) (WEC 2014b). WEC sends the calcium fluoride offsite for reuse in concrete (NRC 2017a). The remaining liquid waste stream is then discharged to the West lagoon for further settling. The ammonia is recovered and returned to the ADU process (WEC 2014b).

After processing in the WWTP, the liquid waste stream is discharged into the Congaree River through a submerged pipe, about 6 meters (m) (20 feet [ft]) from the shore. The flow rate into the river is 492,000 liters per day (L/d) (130,000 gallons/d [gpd]), assuming a nominal operating capacity (WEC 2015a).

2.3.3 Solid Waste

WEC will continue to generate several types of solid waste from the continued operation of the CFFF—combustible, hazardous, industrial, and radioactive wastes. WEC manages these wastes by a combination of onsite processing, permitted onsite storage, transportation offsite for disposal, incineration, and recycling. WEC does not generate mixed waste—waste that contains both hazardous and radioactive waste.

Combustible wastes are packaged in compatible containers, assayed for U-235, and stored to await incineration. 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 2014b). Sections 1.3.2 and 3.9 of the 2007 EA describe the solid waste streams and waste management at CFFF; therefore, this section provides a summary and describes any changes that have occurred since 2007.

Hazardous wastes such as degreasing solvents, lubricating and cutting oils, and spent plating solutions are generated at CFFF. These wastes are regulated under 40 CFR Part 261, "Identification and Listing of Hazardous Waste"; 40 CFR Part 262, "Standards Applicable to Generators of Hazardous Waste"; and South Carolina Hazardous Waste Regulations R61–79.261. Hazardous Waste Generation Reports are provided on a quarterly basis to the SCDHEC. The wastes are stored on an onsite storage pad until they are shipped for disposal offsite through permitted contractors. WEC is a large quantity generator of hazardous wastes and produces approximately 48,000 kilograms (kg) (106,000 pounds [lb]) annually, based on the 2013 generation rate (WEC 2014b, 2015a).

WEC generates industrial and municipal waste from routine industrial and office activities. Solid wastes include general plant trash as well as items such as computers, oil filters, rags, and batteries. Solid wastes are disposed offsite at a local, State-permitted landfill (WEC 2014b, 2015a). In 2012, WEC implemented a recycling program for wood, corrugated cardboard, and rigid plastics. Since then, the amount of solid waste (plant trash) generated was reduced from 605 MT (665 tons [T]) to 292 MT (322 T) in 2012 and 2013 (WEC 2014b) and further reduced to 148 MT (163 T) in 2014 (WEC 2015a). Approximately 4,218 kg (9,300 lb) of other solid wastes, such as oil filters, rags, batteries, and computers, are generated per year, based on the 2013 generation rate. These wastes are stored on the onsite storage pad (WEC 2014b). WEC has also implemented a food composting program to reduce food waste (NRC 2017a).

The CFFF operations produce a variety of low-level radioactive wastes (LLW), including used packaging, clothing, paper, and tools. After sorting, the LLW is transferred to an onsite waste processing station, where radiation surveys are conducted. The waste may then be decontaminated for free-release or reuse, incinerated onsite, or shipped offsite for disposal at the Barnwell site in South Carolina. Since 2008, the amount of LLW WEC has shipped offsite has ranged from 367 m^3 (12,600 ft^3) to 733 m^3 (25,898 ft^3). This is a decrease from previous years, which included shipments of up to 5,132 m^3 (181,235 ft^3) (WEC 2015a).

WEC has a sustainability policy that is implemented at the CFFF through a formal environmental management system. Waste minimization goals and practices include

minimizing raw materials and energy use, reducing waste types and quantities, reusing and recycling materials and resources when economically and technically feasible, and continually seeking to improve performance in these areas. A sustainability and environmental management plan that describes the improvement plan for that year is issued every year. WEC also requires annual refresher training for employees and educates CFFF employees about taking proper actions to reduce or prevent the generation of radioactive and mixed waste (WEC 2018a).

2.4 Monitoring Programs

WEC conducts environmental monitoring and sampling to comply with State requirements established by SCDHEC and to comply with its NRC license. The different monitoring programs are described below.

2.4.1 SCDHEC National Pollutant Discharge Elimination System Permit

As part of its National Pollutant Discharge Elimination System (NPDES) permit (SC0001848), issued by SCDHEC, WEC monitors and collects Congaree River and ground-water samples. WEC's NPDES permit sets the requirements for its discharge into the Congaree River. The permit establishes the effluent parameters, their limitations, and monitoring requirements. Some of the parameters monitored include pH, total suspended solids, fluoride, ammonia-nitrogen (as nitrogen), and E.coli (SCDHEC 2017a). The NPDES permit was last modified on March 30, 2017 and expired in March 2018 (SCDHEC 2017a). However, WEC submitted a timely renewal application for its NPDES permit to SCDHEC in September 2017 (WEC 2017d). The NPDES permit must be renewed every five years.

In September 2015, SCDHEC informed WEC that regulatory oversight for ground-water monitoring related to previous releases determined to be from the WWTP lagoons would be managed by the SCDHEC's Bureau of Water (AECOM 2017). Therefore, ground-water monitoring requirements were added to the NPDES permit. To comply with its current NPDES permit requirements, WEC monitors ground-water conditions for water-table elevation, pH, specific conductance, fluoride, nitrate, volatile organic compound (VOCs), gross alpha, gross beta, fission, activation products, and tritium (SCDHEC 2017a). The current NPDES permit requires semi-annual sampling but WEC takes ground-water samples quarterly, typically in October, January, April, and July. WEC provides annual reports to SCDHEC with the sampling results (SCDHEC 2017a). WEC has committed to submitting those annual NPDES reports to the NRC during the license renewal period (WEC 2017d).

WEC has been collecting samples from different wells, on different frequencies, and for different contaminants to satisfy NRC and SCDHEC monitoring requirements. As part of the NPDES renewal program and the NRC license renewal, WEC is proposing to modify its ground-water monitoring program to develop a comprehensive sampling program that addresses the requirements of both SCDHEC and the NRC. The SCDHEC will review the ground-water monitoring changes during its review of the NPDES permit renewal application. As part of the NPDES renewal process, the monitoring requirements for SCDHEC are subject to change, including the number of wells monitored, the frequency of monitoring, and for which constituents. WEC requested in its NPDES permit renewal application to remove sampling

requirements for fission, activation products, and tritium. SCDHEC is still reviewing WEC's renewal application (WEC 2017d). WEC will notify the NRC when the NPDES permit is renewed and provide a copy of the renewed NPDES permit (WEC 2018a). The NRC coordinated with SCDHEC as part of its license renewal review.

2.4.2 SCDHEC Voluntary Cleanup Contract

In March 2013, SCDHEC informed WEC that future assessments and remedial actions taken at the CFFF site would be evaluated following the U.S. Environmental Protection Agency's (EPA) Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA 1988). The CERCLA process provides a methodology for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and for evaluating remedial options. SCDHEC requested that WEC submit a Remedial Investigation (RI) report followed by a Baseline Risk Assessment (BRA) report. The RI report, completed in 2013, provides a summary of previous investigations, a limited characterization of the site, and identifies chemicals of potential concern (COPCs) that needed further evaluation (AECOM 2013). WEC prepared a BRA in 2014 that evaluated the exposure setting, conceptual site model, and screening of collected data between 2008 and 2014 (AECOM 2014). The purpose of the BRA is to determine whether remedial action is necessary and the level and extent of cleanup needed to reduce risk.

In September 2015, the SCDHEC informed WEC that regulatory oversight for VOC contamination in ground water would be managed by the Bureau of Land and Waste Management (AECOM 2017). Then, in June 2016, WEC entered into a Voluntary Cleanup Contract (VCC) (16-4948-RP) with SCDHEC, pursuant to the Brownfields/Voluntary Cleanup Program, the CERCLA, and the South Carolina Hazardous Waste Management Act. The contract requires WEC to develop a work plan that includes a long-term ground-water monitoring program to be reviewed and approved by SCDHEC (SCDHEC/WEC 2016). As required by the VCC, WEC performed field screening for VOCs and developed a proposal for the installation of additional permanent monitoring wells, which SCDHEC is currently reviewing (WEC 2017d). WEC must submit a long-term ground-water monitoring plan for VOCs to SCDHEC for review and approval. The SCDHEC could require WEC to prepare a Feasibility Study to evaluate remedial alternatives for the VOCs (AECOM 2017).

2.4.3 NRC License

WEC has an Environmental Protection Program that includes monitoring of samples of air, soil, sediment, ground water, surface water (including river water), vegetation, and fish. WEC's monitoring program is included as Chapter 10 of its license renewal application (WEC 2017d). The monitoring and sampling requirements have evolved to ensure there would be no significant impact from continued operations (NRC 1985, 1995). The monitoring program changes are captured in WEC's license renewal application (Chapter 10). Table 2-2 summarizes the environmental monitoring program for this license renewal period. WEC would be required to conduct the monitoring and sampling as documented in Chapter 10 of its application. However, WEC can make changes to its sampling criteria, sensitivities, and/or locations without NRC approval if WEC documents its evaluation that the changes will not

decrease the overall effectiveness. Changes made must be reflected in future updates to the license application (WEC 2018a).

Table 2-2. Environmental Monitoring Program (adapted from Table 10.1 from WEC 2018a)

Type of Sample	Locations	Analyses	Minimum Sampling Frequency
Air Particulates	Four	Alpha	Continuous (Collection Weekly)
Surface Water	Six	Alpha[(b)]; Beta[(b)]	Quarterly
Well Water[(a)]	Twenty-Five	Alpha[(b)]; Beta[(b)]	Semi-Annually
River Water	Four	Alpha[(b)]; Beta[(b)]	Quarterly
Sediment	Three	Alpha[(b)]; Beta[(b)]	Annually
Soil	Five	Alpha[(b)]; Beta[(b)]	Annually
Vegetation	Four	Alpha[(b)]; Beta[(b)]; Fluoride	Annually
Fish	One	Alpha[(b)]; Beta[(b)]	Annually

a. Well water is monitored for gross alpha and gross beta activity according to the schedule listed in Table 10.2 (Table 2-3 in this EA).

b. If gross alpha activity exceeds 15 pCi/L or 15 pCi/g, as applicable, isotopic analyses for uranium is performed. If gross beta exceeds 50 pCi/L or 50 pCi/g, as applicable, Tc-99 analyses are performed. Environmental monitoring data from Table 10.1 is summarized in the annual ALARA report. If surface water or well water were to exceed state or federal regulatory limits a CAP is entered to document the action(s) taken in response to the elevated analysis results.

The environmental samples are analyzed for gross alpha and/or gross beta activity. Vegetation is also tested for fluoride. See Table 2-2 for the types of samples, number of locations, analyses, and minimum sampling frequency with specified conditions for additional monitoring and analyses based upon the sampling data. If investigation levels are exceeded for gross alpha (15 pCi/L or 15 pCi/g) or gross beta (50 pCi/L or 50 pCi/g), then isotopic analysis for uranium and/or Tc-99 analysis, respectively, will be conducted. WEC's investigation limit for gross alpha is equivalent to the EPA's drinking water standard for gross alpha, 15 pCi/L. If isotopic analysis for uranium is performed and the action level for uranium is exceeded and/or if results of the Tc-99 analysis exceed the action level, then WEC would develop an action plan that would be incorporated into the Corrective Action Program (CAP). The action levels are the regulatory limits, which are the EPA's drinking water Maximum Contaminant Levels (MCLs), enforced by SCDHEC. For uranium, the action level is the 30 ug/L MCL and for Tc-99, the action level is the 900 pCi/L MCL.[3] As part of this license renewal review, the NRC has imposed a license condition requiring WEC to develop an action plan to be incorporated into its CAP if action levels are exceeded in the surface water or ground-water.

The NRC would ensure WEC complies with its environmental monitoring program, documented in Chapter 10 of its license renewal application, through continued oversight and annual

[3] Derived concentrations can be found at: https://www.epa.gov/sites/production/files/2015-09/documents/guide_radionuclides_table-betaphotonemitters.pdf.

inspections, or more frequently if needed. NRC regulations establish the threshold for reportable events (e.g., 10 CFR 20.2203, Appendix A to 10 CFR Part 70).

2.4.3.1 Soil and Vegetation

WEC collects four soil samples and four vegetation samples annually and analyzes them for gross alpha and gross beta activity. If investigation levels are exceeded, then additional isotopic analysis will be conducted. The vegetation samples are also analyzed for fluoride. (WEC 2018a). The soil and vegetation samples are collected at the same locations as the ambient air samples (see Figure 2-4).

2.4.3.2 Air

WEC conducts representative stack sampling from 47 stacks to monitor gaseous effluents. Sampling and monitoring methods and frequencies are determined by WEC. The results of the stack sampling are reported in WEC's effluent reports submitted to the NRC.

In addition to stack sampling, WEC continuously monitors ambient air at four onsite locations (see Figure 2-4) for the presence of gross alpha activity and collects samples weekly (WEC 2018a).

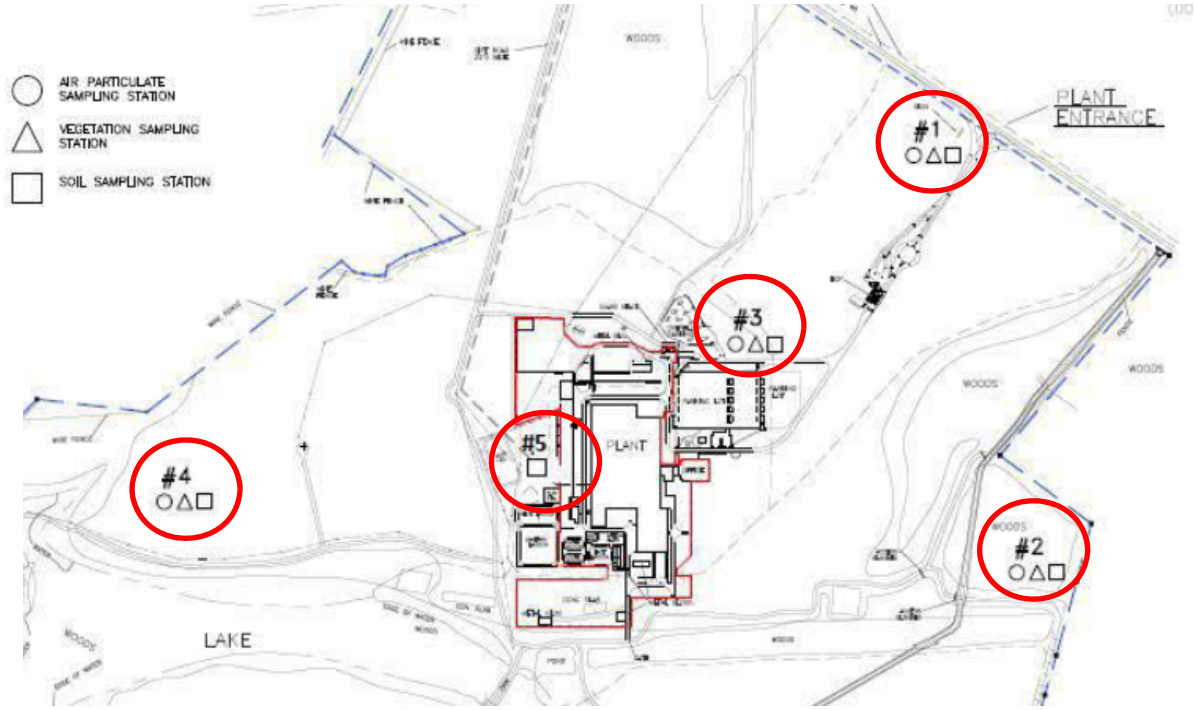

Figure 2-4. Sampling Locations for Air, Vegetation, and Soil (Adapted from Figure 10.1 in WEC 2018a)

2.4.3.3 Surface Water and Sediment

WEC will take six surface water samples quarterly from the locations shown in Figure 2-5. WEC analyzes the samples for gross alpha and gross beta activity. If investigation levels are exceeded, further analysis is conducted (WEC 2018a).

WEC will collect sediment samples from Sunset Lake, Gator Pond, and at or near the point of discharge into the Congaree River. Samples will be collected annually and will be analyzed for gross alpha and gross beta activity. If investigation levels are exceeded, further analysis will be conducted (WEC 2018a).

Figure 2-5. Surface Water Sampling Locations (Figure 10.2 from WEC 2018a)

2.4.3.4 Congaree River

As part of its monitoring program for the NRC license, WEC collects Congaree River samples quarterly from four locations—at the Blossom Street Bridge 10 mi upstream of CFFF discharge point, 500 yards (yd) upstream, 500 yd downstream of the discharge point, and at Mill Creek. The samples are tested for gross alpha and gross beta activity. If investigation levels are exceeded, further analysis is done (WEC 2018a).

2.4.3.5 Fish

WEC collects a fish sample annually from the Congaree River near the point of discharge. The fish samples are tested for gross alpha and gross beta. If investigation levels are exceeded, further analysis is conducted (WEC 2018a).

2.4.3.6 Ground water

For the previous license renewal period (approved in 2007), WEC monitored 10 ground-water wells and analyzed samples annually for gross alpha, gross beta, ammonia, fluoride, and nitrate (WEC 2007). During this license renewal period, WEC will increase the number of wells to 25 (up from 10) and the frequency of sampling will be semi-annual. The samples will be analyzed for gross alpha and gross beta. If investigation levels are exceeded, further isotopic analysis will be conducted to help determine the source of the gross alpha or gross beta activity. Figure 3-22-3 indicates the current wells onsite and which wells will be monitored for gross alpha and/or gross beta activity. If a sample concentration exceeds the State or Federal regulatory limit, then WEC will develop an action plan and incorporate it into its CAP (WEC 2018a).

Table 2-3. Ground-water Monitoring for Radionuclides (based on Table 10.2, WEC 2018a)

Well	Gross Alpha	Gross Beta
WRW-2	X	X
W-3A	X	X
W-7	X	X
W-10	X	X
W-13	X	X
W-14	X	X
W-15		X
W-16		X
W-17		
W-18	X	X
W-19		
W-20	X	
W-22	X	X
W-23	X	
W-24		
W-26		X
W-27	X	X
W-28		
W-29	X	
W-30	X	X
W-32		X
W-33	X	
W-35		
W-36		
W-37	X	X
W-38	X	
W-39	X	X
W-40		
W-41	X	
W-42		
W-43	X	
W-44	X	
W-45		
W-46		
W-47	X	X
W-48		
W-49		
W-50		

2.5 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. Depending on what WEC decides to do with the site after decommissioning, WEC would have to ensure the site meets applicable NRC regulations for either unrestricted or restricted release. Unrestricted release, defined in 10 CFR 20.1402, means the residual radioactivity distinguishable from background radiation results in a total effective dose equivalent to an average member of the critical group that does not exceed 25 millirem per year (mrem/yr), including that from ground-water sources of drinking water, and that the residual radioactivity has been reduced to as low as is reasonably achievable (ALARA) levels.

Per 10 CFR 70.38(g), all material licensees are required to submit a decommissioning plan (DP) to the NRC for review and approval. The DP, to be implemented at the end of the license period, describes how the facilities and grounds will be decontaminated so that they can be released for unrestricted or restricted use. The environmental impacts of decommissioning activities are addressed in the cumulative impacts analysis in Section 6 of this EA.

Adequate planning and funding need to be in place for the eventual decommissioning of the CFFF. WEC submits its Decommissioning Funding Plan (DFP) to the NRC at intervals not to exceed 3 years in accordance with 10 CFR 70.25(e)(2). 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. WEC most recently submitted its DFP in 2016 (WEC 2016a), which the NRC approved (NRC 2016d). The NRC considers the current state of site contamination and expected remediation provided by WEC when reviewing the DFP for approval.

3. AFFECTED ENVIRONMENT

The NRC has incorporated by reference Section 3 “Affected Environment” of the 2007 license renewal EA (NRC 2007). This section provides a framework for the environmental impacts discussion and a high-level summary of any significant changes for each resource area since 2007.

3.1 Land Use

The CFFF is located on an approximately 469-ha (1,158-ac) site in Richland County, South Carolina, approximately 13 km (8 mi) southeast of the City of Columbia. CFFF operations and support activities occur on about 24 ha (60 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). Section 3.1 of the 2007 EA provides more detail about the site and land use within 8 km (5 mi) of the site.

A variety of activities are conducted in the undeveloped portion of the site. These activities include management of the forested areas for timber production and harvesting of hay fields. Recreational facilities include a fitness trail, softball field, and a picnic pavilion for WEC employee use, and employees are permitted to fish and hunt in designated areas on the CFFF property. Additionally, the Denley Cemetery, which operated from about 1890 to 1940, is located approximately 304 m (1,000 ft) southeast of the CFFF. The cemetery contains more than 100 graves of African-Americans (WEC 2014b).

South Carolina Electric and Gas constructed an electrical substation on approximately 2.8 ha (7 ac) along the northwest border of the CFFF property, near Bluff Road, on land purchased from WEC in 2005 (WEC 2014b).

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

3.2 Geology, Seismology, and Soils

Section 3.6 of the 1985 EA provides information about the regional and site geology, seismology, and soils. The southeastern portion of Richland County, where CFFF is located, is within the upper Coastal Plan, a subprovince of the Atlantic Coastal Plain. The site is located in the subcrop of the upper Cretaceous Tuscaloosa formation (NRC 1985).

The CFFF site is in a region of low or no potential for earthquake hazards (SCDNR 2017). The Charleston seismic region, about 145 km (90 mi) to the southeast, is the nearest source of significant seismic activity (WEC 2014b).

CFFF operations have affected soil quality. WEC has performed onsite soil sampling as part of previous site investigations. Those investigations determined that a former oil house and the solvent extraction area, including the north end of the WWTP, were the sources of the soil contamination. Storage of petroleum products and solvents prior to 1980 at the former oil

house, located just west of the main plant building, likely caused VOC contamination. The solvent extraction area, located at the southwest corner of the plant building likely caused gross beta contamination. Contaminants in the subsurface can migrate downward to the shallow water table with percolating rainwater. The VOC contamination in the soil is most likely the source of the VOC contamination in the ground water (AECOM 2013).

In 2011, WEC discovered that a buried piping system running beneath the Uranium Recycling and Recovery Services (URRS) area had developed a leak. The URRS area is located in the southwest corner of the main facility. The leak occurred in a heavy cast-iron pipe that conveyed contaminated wastewater. During its investigation of the pipe leak, WEC found a second breach in the piping system. WEC also identified a large void underneath the building floor during the investigation. It is unclear whether the void space is caused by liquid released from the pipe leak, by soil erosion caused by subsurface stormwater, or by consolidation and subsidence of backfill building materials and soils. The depths of the pipe sections in which the leaks were found ranged from 2 to 9 ft below floor grade. The ground water beneath the URRS area is estimated to be 9 to 16 ft below land surface, based on sampling completed at nearby wells (WEC 2017d, 2018b).

WEC does not know how long the pipe was leaking or the total volume of liquid and contaminants that was released. Due to the limited access to the subsurface, WEC took four core borings to depths between 6 to 8 ft deep and collected soil, sludge, and liquid samples. The samples showed elevated levels of uranium, as shown in Table 3-1 below. WEC suspects the liquid collected came from the damaged pipe.

Table 3-1. Sampling Results of URRS Borings for Uranium (Source: WEC 2018b)

Media Analyzed	Boring 1	Boring 2	Boring 3	Boring 4
Soil	408.0 pCi/g	2.47 pCi/g	373.6 pCi/g	374.4 pCi/g
Sludge	--	--	405.1 pCi/g	--
Liquid	--	--	--	98,120 pCi/L

After investigating, WEC abandoned in place the old pipe and replaced it with an above-ground piping system. During decommissioning, WEC intends to remove the contaminated soil beneath the building, package it for transport, and ship it offsite for disposal. WEC calculated that the volume of soil to be removed would be approximately 82,000 ft^3, equivalent to the total area beneath the building to a depth of 10 ft (WEC 2017d, 2018b). WEC included the estimated costs for removal and remediation associated with the 2011 pipe leak in its 2016 DFP (WEC 2016a). For this license renewal period, WEC has included well (W-37) in its performance monitoring schedule and a new soil sampling location (SED-5/SW-5) to monitor whether the uranium leaches into the shallow water-table aquifer and spreads beyond the URRS area.

Near-surface soil samples collected between January 2011 and November 2015, as part of WEC's environmental monitoring program, show uranium concentrations range between 2-4 pCi/g (NRC 2017a). Natural uranium is generally present in soil at an average value of about 0.6 pCi/g (Eisenbud and Geselle 1997). The NRC's 1977 EA reported that the background radiological concentrations of the soil in the CFFF environs was typically less than

1 pCi/g total uranium (NRC 1977). Section 4.2 provides a more detailed discussion of the impacts on soil as a result of CFFF operations.

3.3 Surface Water Resources

This section provides a high-level summary of surface water resources, based on the NRC's 1985 and 2007 EAs (Sections 3.5.1 and 3.4.1, respectively) and information provided by WEC in support of its license renewal application.

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. Congaree River flow depends on the inflows from the Broad and Saluda River basins. Broad River flow is regulated by the Parr Shoals Dam and Saluda River flow is regulated by the Lake Murray Dam (NRC 2007). The average flow of the Congaree River in the vicinity of the CFFF is 8,652 cubic feet per second (cfs) based on water data for 1940 through 2016 (NRC 2018a).

In the vicinity of CFFF there are other surface waters: 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).

There are several surface water bodies within the CFFF site boundary (see Figure 3-1). Located southwest of the plant building, Sunset Lake is fed by Mill Creek, which is a tributary of the Congaree River. Mill Creek continues as an outflow from Sunset Lake to the west through a swamp area that discharges into the Congaree River about 3 mi south of the site (AECOM 2013; NRC 2007). Manmade Gator Pond, which is fed by a natural spring, sits 500 ft southwest of the WWTP. Gator Pond existed prior to construction of the CFFF (AECOM 2013).

3.3.1 Surface Water Use

WEC gets all of its water from the City of Columbia, which takes water from the Congaree River. WEC consumes 5.58×10^7 gallons of water per year, based on the average rates from 2008 to 2013. The other major industrial water user within the Congaree watershed is the Carolina Eastman Company. Municipal users also include the City of Cayce and East Richland County Public Service District Gills Creek Plant. WEC does not use any water from Mill Creek, Sunset Lake, or Gator Pond (WEC 2014b).

WEC discharges its liquid effluent directly into the Congaree River. WEC discharges 492,000 L/d (130,000 gpd) (WEC 2015a). The average effluent discharge flow from CFFF is 0.161 cfs (0.104 Mgd) (NRC 2018a). Based on the average flow of the Congaree River (8,652 cfs), the volume of CFFF discharged effluents represents less than 0.001 percent of the overall river flow.

Figure 3-1. Onsite Surface Water Bodies (Adapted from Google Map)

3.3.2 Surface Water Quality

Section 2.3.2 describes the liquid effluents discharged to the Congaree River and Section 2.4 describes the monitoring and sampling program WEC has in place for surface water onsite and within the Congaree River. The quality of the Congaree River and the surface water onsite has been affected by CFFF operations.

3.3.2.1 Congaree River

Within the Mill Creek portion of the Congaree River basin, where CFFF discharges its liquid effluent, there are naturally low pH conditions, decreasing trends in total phosphorus concentrations, and upward trends for dissolved oxygen (SCDHEC 2017b). The SCDHEC lists several segments of the Congaree River as being impaired for recreational use due to reported *Escherichia coli* (*E. coli*) concentrations (SCDHEC 2014).

As described in Section 2.4.1, WEC has a NPDES permit from SCDHEC to discharge into the Congaree River (Permit No. SC0001848); the permit imposes effluent limitations and monitoring requirements. WEC must ensure the liquid discharge meets the NRC's 10 CFR Part 20 effluent limits for radiological components. The average annual rate of uranium released to the Congaree River for 2003 through 2012 was 18.4 mCi. WEC began monitoring for Tc-99 in its NPDES release starting in 2010. The average annual release rate of Tc-99 for 2010 to 2012 is 17.2 mCi (WEC 2014b). As part of its annual effluents reports submitted to the NRC, WEC calculates dose based on its liquid effluent discharged to the Congaree River and gaseous effluents. Doses have been under 2 mrem/yr (e.g., WEC 2017c).

Samples collected from the Congaree River between 2010 and 2015, as part of WEC's environmental monitoring program required by its NRC license, show gross alpha

concentrations are less than 10 pCi/L, which is lower than the 15 pCi/L standard. Annual sediment samples taken from the Congaree River during the same timeframe show uranium levels are below 2 pCi/g (NRC 2017a).

3.3.2.2 Onsite Surface Water

WEC has a general NPDES permit for storm water discharges (Permit No. SC0001848), which requires implementation of a Storm Water Pollution Prevention Plan (WEC 2014b). Drainage at the site moves either through overland flow or through a storm water drainage system. The drainage ditches converge west of the Sanitary Lagoon and then flow to the west until they discharge through the single storm water outfall into an upstream area of Upper Sunset Lake (Mill Creek). Flow from Mill Creek and Sunset Lake enters the Congaree River about 5 km (3 mi) downstream (NRC 1985).

Onsite surface water has been contaminated with radiological and nonradiological constituents: VOCs, gross alpha, gross beta, fluoride, nitrate, and ammonia. Contaminants migrate in surface water flow through the ditch system. Some ditches also intersect ground water (toward the northwest and west). Contaminants found in Gator Pond could also be from ground water discharge (AECOM 2013).

Results for surface water samples taken as part of WEC's environmental monitoring program between 2011 and 2015 show that gross alpha was below the existing investigation limit (50 pCi/L), and thus no isotopic analysis was performed. However, the results indicate that the drinking water standard for gross alpha, 15 pCi/L, has been exceeded at the "roadway" sample location (see Figure 2-5) (NRC 2017a). During license renewal, WEC has committed to an investigation level of 15 pCi/L, to correspond to the EPA's gross alpha drinking water standard. If samples exceed that limit, further isotopic analysis will be performed. Corrective action will be taken if action levels are exceeded (WEC 2018a).

In October 2015, the CFFF site received 15 inches of rainfall over a 3-day period. As a result, two process lagoons overflowed beyond containment. The sanitary lagoon spilled over into adjacent lagoons. The West-II lagoon overflowed but stayed within the bermed area. WEC initiated an emergency discharge to the river. WEC staff conducted in-process sampling for fluoride, ammonia, pH, and total suspended solids (TSS), and also took activity samples. There was one elevated TSS reading and the highest activity readings were 100 and 10 pCi/L (WEC 2018a). 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. WEC notified SCDHEC of the event and SCDHEC did not require any further action by WEC (WEC 2015a). No supplemental sampling of environmental media was conducted during or immediately following the flooding event (NRC 2017a).

3.3.3 Sediment

In July 2013, as part of a previous site investigation and based on communication with SCDHEC, WEC collected sediment samples from 10 onsite locations. Samples were analyzed for tetrachloroethene (PCE), fluoride, nitrate, gross alpha, and gross beta among others. While

there are no standards for contaminants in sediments, Table 3-2 summarizes the highest concentration of some contaminants and their locations.

Table 3-2. Results of July 2013 Sediment Sampling Event (AECOM 2013)

Contaminant	Concentration	Location[a]
Fluoride	220 mg/kg	Gator Pond
PCE	30 ug/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 RI report (AECOM 2013).

3.3.4 Wetlands and Floodplains

Eighteen wetland areas are located on the CFFF property. Of those, 14 are wetlands within the 100-year floodplain and would be considered under the jurisdiction of the U.S. Army Corps of Engineers and subject to protection under Section 404 of the Clean Water Act (NRC 2007). The remaining four wetlands are not within the 100-year floodplain and therefore do not fall under the jurisdiction of the Army Corps (NRC 2007).

Sunset Lake, a shallow artificial impoundment on Mill Creek, is primarily a wooded swamp with some open water in the lower part (NRC 1988). The southern portion of the site, including Gator Pond, Mill Creek, and Sunset Lake, is located within the floodplain of Mill Creek and the Congaree River. A bluff, about 20 ft high, separates the plant and WWTP from the floodplain (AECOM 2014).

The CFFF site is located within the flood basin of the Congaree River. The flood stage for the Congaree River at the Carolina Eastman gauging station is 35 m (115 ft) above mean sea level (MSL). The CFFF site elevation ranges from 34–44 m (110–140 ft) MSL. Flooding occurs when the river level rises above the flood stage and backs up water in the floodplains (WEC 2014b). 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 2017).

3.4 Ground-Water Resources

The 1985 EA (Section 3.5.2) and the 2007 EA (Section 3.4.3) describe the ground water and hydrology at the CFFF site. The ground water at and near CFFF occurs in multiple aquifers, and those below the water-table aquifer are under confined conditions. There is a shallow, unconfined water-table aquifer, which includes sediments of the Okefenokee and Wicomico formations. The shallow ground water principally flows from areas of higher topography (e.g., in and around the main facility) to lower topography (e.g., Mill Creek floodplain). Below the shallow water-table aquifer is a confining hydrogeologic unit of the upper Black Mingo formation, a 10- to 20-m aquitard. Beneath the confining layer is a deeper confined aquifer that is capable of providing large quantities of water for industrial and/or municipal use (NRC 1985). This deeper aquifer is the Black Mingo aquifer located within the lower Black Mingo formation (AECOM 2013). Below the Black Mingo aquifer is the Middendorf Aquifer System (or Tuscaloosa), which also contains an artesian sand aquifer (AECOM 2013). It is unclear

whether there is a hydraulic boundary between this sand and the uppermost Tuscaloosa aquifer; the two hydrogeologic units may behave locally as a single aquifer (NRC 1985).

Ground-water flow velocities for the shallow water-table aquifer were estimated to be 153 ft/yr. The potential flow between the shallow aquifer and the Black Mingo aquifer is downward to the west of the facility (near wells W-42 and W-50), and locally upward near Gator Pond (near wells W- 3 and W- 4), which is at a lower topography. However, due to the properties of the Black Mingo confining bed, significant transfer of water between the two aquifers is precluded (AECOM 2013).

The SCDHEC classifies the ground water at the CFFF site as “Class GB”, meaning ground waters of the State that meet the definition of underground sources of drinking water as defined by State regulations in R.61-68, “Water Classifications and Standards.” WEC requested that SCDHEC reclassify the site as a ground-water mixing zone, as defined in R.61-68, but SCHDEC denied the request (AECOM 2013).

3.4.1 Ground-Water Use

WEC does not use ground water for operations at CFFF. As noted in Section 3.3.1, service and potable water are provided by the City of Columbia, which gets its supply of water from the Congaree River.

According to WEC, there are no known drinking water sources within 3 mi downstream of the facility (WEC 2018a). The RI report indicated that adjacent properties did not use ground water (AECOM 2013). Well records from South Carolina Department of Natural Resources (SCDNR) indicate there are ground-water wells for domestic use within 5 km (3 mi) of CFFF, but they are located upgradient from CFFF (SCDNR 2017). Figure 3-2 shows there are no drinking water wells located in the direction of the ground-water flow, which is generally southwest toward the Congaree River.

Figure 3-2. Location of Ground-water Wells near CFFF (Source: SCDNR 2017; CFFF is circled)

3.4.2 Ground-water Quality

Ground-water contamination was discovered in the 1980s and has been the subject of ongoing investigations (NRC 1985). The ground-water quality has been affected by nonradioactive and radioactive contaminants from CFFF operations—VOCs, gross alpha, gross beta, fluoride, nitrate, and ammonia. Previous investigations, summarized in the RI report, concluded ground-water contamination originated primarily from two sources: the WWTP and the former oil house, which are discussed in more detail later in this section.

In addition, there was the 2011 pipe leak which released uranium beneath the URRS area. As part of the characterization of the pipe leak, WEC collected four soil and sludge samples and one water sample. WEC stated that the water sample was suspected to be the contents of the damaged pipe because the total uranium concentration was so high, approximately 98,000 pCi/L. This pipe leak was not addressed in the RI report or BRA report.

The following summary of the various constituents found in the ground water is based on data in WEC's 2013 RI report and 2014 BRA report, annual reports submitted to SCDHEC, supplemental information submitted to the NRC, and other WEC reports (e.g., ALARA reports).

3.4.2.1 Nonradiological Contaminants

The ground water at CFFF has been contaminated with VOCs and inorganics from CFFF operations. Storage of petroleum products and solvents prior to 1980 at the former oil house contributed to the VOC contamination. The oil house has been removed. The WWTP is suspected of being the source of the organics—nitrate, fluoride, and ammonia. Four of the WWTP lagoons were relined between 2008 and 2012.

Volatile Organic Compounds

The VOCs contaminating the ground water are primarily PCE and its breakdown products. WEC installed an air sparging/soil vapor extraction (AS/SVE) system in 1997 and operated it until 2011. The AS/SVSE system appears to have reduced VOC concentrations in the ground water. In December 2012, WEC discontinued operation of the AS/SVE system because reductions in contaminants were no longer being seen (WEC 2015a). However, since the AS/SVE system has been turned off, the VOC concentrations have been increasing (SCDHEC/WEC 2016).

The VCC signed by WEC and SCDHEC requires WEC to develop a work plan that includes a long-term ground-water monitoring program to be reviewed and approved by SCDHEC (SCDHEC/WEC 2016). WEC submitted a proposal to install additional ground-water wells for monitoring the VOC contaminant plume. WEC had to conduct further field screening to delineate the extent of ground-water contamination. Preliminary results, being reviewed by SCDHEC, indicate the VOC plume has not been completely delineated. WEC's field screening report indicates there are two separate semi-VOC (sVOC) plumes. The report indicates that one plume appears to come from the West-II Lagoon, and it features elevated PCE concentrations in the shallow and intermediate water tables. The second plume is south of the WWTP, upgradient of Gator Pond, and its PCE concentrations appear to be confined to the shallow aquifer. The field screening report states that the source of this plume is unknown.

WEC proposes to install additional monitoring wells—five shallow and five intermediate wells (AECOM 2017). These wells could help WEC understand the plume's behavior and possibly determine its origin. SCDHEC is currently reviewing WEC's report.

Fluoride and Nitrate

Activities at the WWTP are believed to be the source of fluoride and nitrate in ground water. The fluoride plumes are located in the vicinity of the WWTP, Gator Pond, and Sunset Lake. Sampled wells continue to show exceedances of the EPA's MCLs for both fluoride (4 mg/L) and nitrate (10 mg/L). The highest concentrations of fluoride are up to 10 mg/L and are found in W-13 and W-30. The highest nitrogen concentrations are as high as 1,300 mg/L and 600 mg/L at W-18 and W-7, respectively.

Characterization efforts for the 2011 pipe leak indicated fluoride in the soil and sludge samples, at 47 mg/kg and 85 mg/kg, respectively. Liquid collected from the boring indicated nitrate levels at approximately 2 mg/L, which is well below the 10 mg/L MCL. The contaminated soil and sludge would remain beneath the URRS area until decommissioning, which will begin after the 40-year license renewal period ends, assuming WEC does not request an additional license renewal period. Therefore, the fluoride could leach through the contaminated soil into the ground water. Fluoride and nitrate move with the ground-water flow, although nitrate concentrations can be lowered through natural processes such as denitrification (AECOM 2013). WEC will continue to monitor for fluoride and nitrate and submit results to SCDHEC in its annual ground-water report as part of its NPDES permit.

Ammonia

Historic leaks near the WWTP and nearby product storage are believed to have caused the ammonia ground-water contamination. The 1985 EA indicated the highest concentration was 900 mg/L (at W-7) in 1981 (NRC 1985). Recent concentrations are down to less than 200 mg/L, and the highest concentrations showed up in W-18 (WEC 2015b). According to WEC, ammonia concentrations have gone down due to remedial actions and natural attenuation (WEC 2015a). The BRA report stated that ammonia was initially identified as a COPC because it had no screening value; however, it was not retained as a final COPC because of its low toxicity, natural occurrences, and the minimal potential for receptor exposure (AECOM 2014).

3.4.2.2 Radiological Contaminants

Previous site investigations indicated that the WWTP contributed to the gross alpha and gross beta contamination. In the early 1980s, five lagoons were relined with 36-Mil Hypalon liners and underdrain systems were installed to detect leaks from the lagoons (NRC 1985). WEC believes its process of removing solids from the bottom of the lagoons was damaging the liners and thus creating a potential for leaks (WEC 2017d). WEC noticed an upward trend in ground-water contaminants, so it replaced four of the six lagoon liners again, this time with 80-Mil HPDE liners (WEC 2017d).

Gross Alpha and Uranium

Sampling results from WEC's ongoing environmental monitoring program indicate gross alpha still exceeds the 15 pCi/L standard for gross alpha. (AECOM 2013; NRC 2017a; WEC 2015a, 2018b). According to WEC's ground-water plume analysis, there appears to be no gross alpha plume but rather spikes in concentrations that appear at different wells during different sampling events. WEC claims the gross alpha exceedances are random and appear to be more characteristic of naturally occurring radionuclides (NRC 2017a). Isotopic analysis for uranium conducted for two ground water wells in 2016 and 2017 showed total uranium was less than 3 pCi/L (NRC 2017a). WEC will monitor ground-water wells semi-annually, during dry and wet seasons, for gross alpha. WEC will continue to perform isotopic analysis if the 15 pCi/L investigation level for gross alpha is exceeded and take corrective action if uranium exceeds the action level (i.e., state or federal regulatory limits).

The 2011 pipe leak that released uranium to the subsurface and into the environment should be considered a source of residual radioactivity and future ground-water and surface water contamination. 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. Based on the isotopic analysis, the uranium is from CFFF operations (mainly U-234). WEC stated that the pipe leak is not a source of ground-water contamination because no elevated concentrations of gross alpha have been detected in the nearby and downgradient ground-water monitoring wells to date. The two closest wells north and south of the leak (W-45 and W-37) were not routinely sampled. However, during a 2011 and 2012 investigation, samples collected at W-45 indicated gross alpha levels exceeded 15 pCi/L, whereas results for W-37 were less than 10 pCi/L (WEC 2018b). A sediment sample taken in 2013 at SW-5/SED-5, which is due east of the leak, showed an elevated level of uranium of 377 pCi/g, whereas the other sediment samples were all less than 25 pCi/g (AECOM 2013). It is also possible that the uranium has not yet migrated downward into the ground water but it could eventually because the contaminated material subject to infiltration and percolation will not be removed until decommissioning. The exact flow of the ground water in this particular location is unclear, but most likely it will flow generally to the southwest.

In the BRA report, gross alpha was maintained as a COPC for future ground-water investigations. The SCDHEC requires monitoring for gross alpha contamination in the ground water through the NPDES permit program, because the source of the gross alpha is assumed to be from the WWTP.

Gross Beta and Technicium-99

Gross beta has been found in the ground-water wells since the early 1980s. In 2010, WEC noticed elevated levels of gross beta that exceeded its investigation level of 50 pCi/L in two wells. WEC determined that the gross beta was primarily due to technicium-99 (Tc-99) based on beta/gamma scans of the samples. WEC evaluated potential sources and causes and determined that the cylinder recertification building and surrounding concrete pad was the source of Tc-99. A tank in the building overflowed onto the floor and spilled outside of the building and onto the grass. WEC excavated grass and topsoil. In 2011, WEC initiated further sampling and monitoring for Tc-99 in ground water (WEC 2015a).

Sampling results through 2016 indicate wells continue to exceed WEC's 50 pCi/L investigation limit for gross beta (AECOM 2013; NRC 2017a; WEC 2015a). Laboratory results for recent ground-water samples indicate the gross beta contamination is due to Tc-99. However, concentrations of Tc-99 are well below its 900 pCi/L MCL. The MCL for Tc-99 is derived from a calculated concentration that will yield a dose of 4 mrem/yr to the total body or any critical organ (EPA 2015).

The plume of gross beta is located in the vicinity of the WWTP, the recertification area, and Gator Pond. Analysis of the gross beta plume, based on historical sampling results, indicates the plume appears to be stable (i.e., not expanding or becoming more concentrated) and centered around the north and south lagoons (NRC 2017a). WEC will monitor ground-water wells semi-annually, during both the dry and wet seasons, for gross beta (WEC 2018a). WEC will continue to perform beta/gamma scans if the 50 pCi/L investigation level for gross beta is exceeded, and will take necessary corrective action if Tc-99 exceeds its action level (i.e., state or federal regulatory limits).

Gross beta was screened out as a COPC for further investigation in the 2014 BRA report because the beta activity was attributed to Tc-99 and no concentrations exceeded the Tc-99 MCL (AECOM 2014).

3.5 Ecological Resources

Section 3.6 of the 2007 EA and Section 3.7 of the 1985 EA provide information about the ecological resources at and in the vicinity of the CFFF. A brief summary of this information is provided below.

3.5.1 Terrestrial Resources

The CFFF site is located within the Southeastern Mixed Forest ecoregion, which is dominated by oak-hickory forests consisting of smaller tree and common shrub species. The undeveloped portions of the site provide a variety of habitats, including wetlands, woodland areas, and hardwood forests. In addition, many areas on the CFFF site that were previously wetlands, woodlands, and forests have been cleared or heavily modified for plant construction and remain as open areas or industrial facilities and roads. 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. However, wildlife in the area is limited in species diversity and is likely 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).

Appendix C of WEC's ER contains a list of species observed or having the potential to occur at CFFF or in the vicinity, based on surveys last completed in 1975 as part of the site evaluation (WEC 2014b).

3.5.2 Aquatic Resources

Aquatic habitats on the CFFF site include Sunset Lake, Mill Creek, and other small creeks, drainage ditches, and floodplains, as described above in Section 3.3 and in Section 3.4 of the 2007 EA. Small fish and invertebrates 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. The NRC staff is not aware of any field surveys on the CFFF site.

The CFFF site is located within the flood basin of the Congaree River, which flows approximately 4 mi (6 km) southwest of the main plant (NRC 2007). Surveys within the Congaree National Park indicate that Congaree River provides habitat to approximately 55 species of fish, 16 species of mussels, and 7 species of crayfish (Congaree Riverkeeper 2017). Common recreationally fished 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). To gather additional data regarding fish populations near CFFF, the NRC staff reviewed survey data that were recorded in an online database, FishNet (2014). 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 CFFF that was conducted in June 2002. The NRC staff notes that the survey methodology, sampling protocols, and equipment were not specified. Therefore, a species may occur near CFFF but may not have been captured in the survey due to insufficient sampling effort and the various survey methods used. Table 3-3 describes fish species that were observed during the survey.

As part of its environmental monitoring program, WEC collects one fish sample each year from a location near or at the diffuser discharge into the Congaree River. The sample is analyzed for gross alpha, gross beta, and uranium. The 2015 ALARA report indicates that no uranium has been detected in the fish samples collected from 2011 to 2015 (WEC 2015a).

3.6 Protected Species and Habitat

The Endangered Species Act of 1973, as amended (ESA) was enacted to prevent further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS) regarding actions that may affect listed species or designated critical habitats. This section discusses species listed under the ESA as well as species protected under other statutes such as the Migratory Bird Treaty Act of 1918, as amended (MBTA).

Table 3-3. Fish Species near CFFF during the 2002 Survey

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

Source: FishNet 2014: Survey conducted on June 19, 2002 on the Congaree River, from 1.0 to 1.5 mi south of Interstate-77, about 5.0 air miles south of the City of Columbia.

3.6.1 State-Listed Species

Table 3-4 describes the State-listed species that have the potential to exist within the CFFF action area. The NRC staff compiled this table from the SCDNR's database (SCDNR 2014), and the ecological studies conducted on and near the CFFF site (WEC 2014b). The last ecological surveys at CFFF were conducted in 1975. Based on those surveys, WEC (2014b) concluded that the southern bald eagle (*Haliaeetus leucocephalus*) and the red-cockaded woodpecker (*Dendrocopus borealis*) may occur on or near CFFF (WEC 2014b).

Table 3-4. State-Listed Species with the Potential to Occur in the CFFF Vicinity

Common Name	Scientific Name	State Status	Habitat
Amphibians			
Pine Barrens Treefrog	*Hyla andersonii*	T	In South Carolina, occurs in herb shrub bogs, pocosins in the sandhills. Colonies known to exist along power lines and gas line right-of ways (SCDNR 2006a)
Birds			
Bald eagle	*Haliaeetus leucoephalus*	T	Large trees with open views for nesting, prefer perch and roost sites with minimal disturbance; fresh, brackish marine habitats suitable for foraging (SCDNR 2006b)
red-cockaded woodpecker	*Picoides borealis*	E	Mature pine forests; excavates cavities in living pine trees.
Mammals			

Common Name	Scientific Name	State Status	Habitat
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	E	Coastal plain habitat, roost in dilapidated buildings or tree cavities near water (SCDNR 2006c)

T = Threatened, E = Endangered

3.6.2 Endangered Species Act

3.6.2.1 Action Area

The implementing regulations for Section 7(a)(2) of the ESA define "action area" as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area effectively bounds the analysis of ESA-protected species and habitats because only species that occur within the action area may be affected by the Federal action.

For the purposes of the ESA analysis in this EA, the NRC staff considers the action area to include the 469-ha (1,158-ac) CFFF site and the surrounding area where runoff drains and site activities would be audible to wildlife. The NRC staff expects all direct and indirect effects of the proposed action to be contained within these areas.

The NRC staff recognizes that while the action area is stationary, Federally listed species can move in and out of the action area. For instance, a flowering plant known to occur near, but outside, of the action area could appear within the action area over time if its seeds are carried into the action area by wind, water, or animals. Thus, in its analysis, the NRC staff considers not only those species known to occur directly within the action area, but those species that may passively or actively move into the action area. The NRC staff then considers whether the life history of each species makes the species likely to move into the action area where it could be affected by the activities associated with continued operations at CFFF.

3.6.2.2 Overview of Federally Protected Species

Table 3-5 describes the Federally listed species that have the potential to exist within the CFFF action area. The NRC staff compiled this table from the FWS's online database and correspondence from FWS (2017), SCDNR's database (SCDNR 2014), and the ecological studies conducted on and near the CFFF site (WEC 2014b). The NRC staff did not identify any candidate species, proposed species, or designated critical habitat within the action area (FWS 2017). The last ecological surveys completed at CFFF were in 1975.

Table 3-5. Federally Listed Species with the Potential to Occur in the CFFF Action Area

Common Name	Scientific Name	Federal Status	Habitat
Birds			
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.
Fish			
Shortnose Sturgeon	*Acipenser brevirostrum*	E	Spawns in coastal rivers, and forages along riverbed or other bottom habitats.
Clams			
Carolina heelspitter	*Lasmigona decorate*	E	Cool, silt-free, well-oxygenated stream bottoms; pollution-intolerant and generally occur in areas with well-vegetated stream banks.
Flowering Plants			
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 loosestrife	*Lysimachia aperulaefolia*	E	Areas in between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil) 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 rights-of-way.

Sturgeon Species

On March 11, 1967, the Shortnose Sturgeon was listed as an “endangered species threatened with extinction” under the ESA, and the species remained on the list of endangered species with the enactment of the ESA in 1973. Construction of dams during the period of United States 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 (NMFS 2015).

Based on the available information, the NRC staff concludes Shortnose Sturgeon likely occur within the CFFF action area. The NRC (2017b) provided detailed information about the Shortnose Sturgeon in its Biological Evaluation submitted to NMFS for their concurrence. NMFS said the NRC should consider the impacts on the Atlantic Sturgeon, because even though it was not present in the Congaree River now it could be within the next 40 years.

3.6.3 Migratory Bird Treaty Act

The FWS administers the MBTA, which prohibits anyone from taking native migratory birds or their eggs, feathers, or nests. Regulations under the MBTA define a "take" differently than the ESA and define "take" as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to" carry out these activities (50 CFR 10.12). Unlike a "take" under the ESA regulations (50 CFR 17.3), a "take" under the MBTA does not include significant habitat alteration or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, such as breeding, feeding, or sheltering.

The MBTA protects a total of 1,007 migratory bird species (75 FR 9282). The FWS (2017) indicated that 22 migratory birds of concern may occur on or near the action area (Table 3-6). Near the proposed site, migratory birds rely on riparian, forested, grassland, and wetlands as important areas for foraging, resting, and avoiding predators and for breeding for some species. Based on the amount of continuous habitat and the limited ongoing human activity that occurs onsite, the CFFF site and surrounding area likely provide quality habitat for migratory birds.

Table 3-6. Migratory Birds of Concern that May Occur near CFFF (Source: FWS 2017)

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

Scientific Name	Common Name	Occurrence in Project Area
Limnothlypis swainsonii	Swainson's warbler	Breeding
Hylocichla mustelina	wood thrush	Breeding
Helmitheros vermivorum	worm eating warbler	Breeding

3.6.4 Bald Eagles

The bald eagle (*Haliaeetus leucocephalus*) is protected under the Bald and Golden Eagle Protection Act. This Federal act prohibits anyone from taking or disturbing bald eagles or golden eagles (*Aquila chrysaetos*), including their nests or eggs, without a FWS-issued permit. The bald eagle is also a State-listed threatened species. Suitable habitat for the bald eagle occurs within the CFFF, but no observations of this species have been documented (FWS 2017; WEC 2014b).

3.6.5 Magnuson-Stevens Fishery Conservation and Management Act

Magnuson-Stevens Fishery Conservation and Management Act, as amended, requires Federal agencies to consult with NMFS on actions that may adversely affect essential fish habitat. There is no essential fish habitat in the project area and therefore no consultation was necessary (NRC 2017c).

3.6.6 Congaree National Park

The Congaree National Park, located 8 km (5 mi) southeast of the CFFF site, is designated as an International Biosphere, a designated Globally Important Bird Area, and a National Natural Landmark. 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 2015).

3.7 Climatology, Meteorology, and Air Quality

Section 3.3 of the 2007 EA for license renewal describes the climatology and meteorology in Richland County. This section provides information updated since 2007.

Richland County is designated as unclassifiable/in attainment for all criteria pollutants for which National Ambient Air Quality Standards (NAAQSs) have been established (40 CFR 81.341). Criteria pollutants include ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead. Previously, portions of Richland County and the neighboring Lexington Counties had exceeded the 1997 8-hour ozone NAAQS, but EPA deferred designating the counties as nonattainment due to participation in the Early Action Compact. As part of this Compact, Richland and Lexington Counties reduced ozone concentrations to meet the NAAQS by the deadline of December 31, 2007, as set by the Compact. On April 15, 2008, both Richland and Lexington Counties were designated as being in attainment of the 1997 8-hour ozone NAAQS (40 CFR 81.341). Richland County is designated as unclassifiable/in attainment

for all NAAQSs, therefore, a conformity analysis for direct and indirect emissions is not required (40 CFR 93.153).

The SCDHEC, Bureau of Air Quality, issued a permit for CFFF operations in May 2003, documenting that the CFFF is neither a “major” source or “significant minor” source with regard to criteria pollutant emissions. The CFFF is classified as a minor-source operator (WEC 2014b). WEC’s permit addresses NAAQS pollutants, nitric acid, and opacity. 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. Emission rates are calculated based on these throughputs because the permit does not require monitoring (WEC 2014b).

WEC monitors radiological gaseous emissions from 47 stacks for compliance with the National Emission Standards for Hazardous Air Pollutants under 40 CFR Part 61. Stacks are outfitted with scrubbers, HEPA filters, or both to minimize effluents being released. Offsite dose is calculated based on the combined emissions concentrations. Ambient air is also monitored at four onsite locations for the presence of radioactive material.

Recent improvements in the emissions and the science of climate change have enabled the U.S. Global Change Research Program (GCRP) to estimate regional climate changes in the United States (GCRP 2014). Projected changes in the climate for the southeastern United States include an increase in average surface air temperature of 4°F to 8°F across the southeast region. The number of days with maximum temperatures above 95°F is expected to increase, rising by 40 or more days per year for the 2041−2070 period relative to the 1971−2000 period.

Projected precipitation changes in the southeast are uncertain. Many of the model projections from the GCRP do not show large changes relative to natural variation in precipitation rates.

Extreme heavy precipitation events are expected to increase in both frequency and intensity; an event that now occurs once in 20 years is projected to occur 3 to 4 times as often by the end of the century. Heavy precipitation events are expected to have a 20 percent increase in the amount of precipitation falling. The GCRP projects that the number of tropical storms occurring around the globe will decrease, but those that occur will be stronger in force, yielding more Category 4 and 5 storms. Rainfall rates associated with tropical storms are expected to be greater, “…with projected increases of about 20 percent averaged near the center of hurricanes” (GCRP 2014).

3.8 Noise

Noise generated at the CFFF is that 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, and engines. The primary source of noise at the site boundary is vehicular traffic (WEC 2014b).

3.9 Historic and Cultural Resources

Section 3.7 of the 2007 EA provides details about the history of the area around the CFFF and lists the nearby historic and cultural properties. The National Register of Historic Places (NRHP) database shows 11 prehistoric and historic sites located within an 8-km (5-mi) radius of the CFFF site (NRC 2007). The South Carolina Department of Archives and History considers five other sites, located within 8 km (5 mi) of CFFF, to have historical significance. None of these sites are located on the CFFF property.

The CFFF site is located near the Congaree River basin, which was exploited by prehistoric inhabitants and historic Tribal groups for its diverse plant and animal resources. The area was home to a small tribe of Congaree Indians that lived along the river. Due mainly to fighting and disease, the small tribe eventually assimilated into the Catawba Tribe.

Onsite, there is a small, fenced cemetery, the Denley Cemetery, which operated from approximately 1900 to 1940. The cemetery contains more than 100 graves of African-Americans (NRC 2007).

On May 12, 2015, the NRC staff issued its determination that no historic and cultural resources would be affected by the proposed 40-year licensing renewal to the South Carolina State Historic Preservation Office (SHPO) (NRC 2015b). The NRC staff also sent a letter to the Catawba Indian Nation to inform them of its determination that no historic and cultural resources would be affected by the proposed action (NRC 2015c). To date, the NRC has not received a response from the Catawba Indian Nation. On May 28, 2015, the South Carolina SHPO concurred with the NRC's determination that no properties listed in or eligible for listing in the NRHP will be affected by the proposed action (SCAHC 2015).

3.10 Visual and Scenic Resources

The CFFF is an industrial complex, located in a semi-rural area and surrounded in part by forested lands (Figure 3-3). The manufacturing facilities are located about 490 m (1,600 ft) from the nearest point on the site boundary. The main manufacturing building for the CFFF is set back approximately 760 m (2,500 ft) from the roadway. Access for vehicle and truck traffic from the CFFF to Bluff Road is provided by the main plant road (WEC 2014b).

Figure 3-3. CFFF Site (WEC 2014b)

3.11 Socioeconomics

The CFFF site is located in Richland County, approximately 13 km (8 mi) southeast of Columbia, the nearest population center. According to the 2010 Census, the State of South Carolina's population was 4,625,364, of which 384,504 resided in Richland County (USCB 2017). It is estimated that 8,668 people live within a 5-mi radius of the CFFF site (WEC 2014b).

There are currently 1,100 employees at the CFFF. This represented 0.6 percent of Richland County employment in 2010 (WEC 2014b).

There are 8 people living within 1 mi (1.6 km) of CFFF, 1,327 within 8 mi (12.8 km), and 8,668 people within a 5-mi (8-km) radius. Those residents live primarily to the northeast along Bluff Road and Atlas Road and to the southeast in the Hopkins, South Carolina area (WEC 2014b).

3.12 Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority or low-income populations that could result from activities associated with the continued operation of the CFFF. Such effects may include human health, biological, cultural, economic, or social impacts. Minority and low-

income populations are subsets of the general public residing in the vicinity of the CFFF, and all are exposed to the same health and environmental effects generated from activities at the CFFF. However, it is the unique characteristics of the minority or low-income populations that create the opportunity for disproportionately high and adverse impacts, relative to the general public.

3.12.1 Minority Populations in the Vicinity of the CFFF

According to the American Community Survey 5-Year Estimates, approximately 47 percent of residents of Richland County, the county in which the CFFF is located, identified themselves as White, compared to 67 percent in the State of South Carolina. In Richland County, approximately 46 percent identified as Black or African American, compared to 28 percent in the State of South Carolina. Less than 3 percent of the Richland County population identified as Asian, and 5 percent as Hispanic or Latino of any race (USCB 2017).

3.12.2 Low-income Populations in the Vicinity of the CFFF

Based on the American Community Survey 5-Year Estimates, the median household income in 2011–2015 for Richland County was $49,131, compared to $45,483 in the State of South Carolina (USCB 2017). In the State, 17.9 percent of the population is below the poverty level compared to 17.1 percent in Richland County (USCB 2017). Differences of greater than 20 percentage points in the block groups (the smallest geographic area for which the U.S. Census Bureau collects and tabulates sample data) compared to the State poverty levels are considered significant. In other words, when a population surpasses the 20 percent greater threshold, that population should receive closer evaluation to determine whether the potential for an environmental justice impact exists (69 FR 52040). Because the population in Richland County does not surpass the 20 percent threshold, a closer evaluation of the population is not necessary.

3.13 Public and Occupational Health

The continued operation of CFFF would result in the potential direct exposure and release of radiological and hazardous materials resulting in potential health impacts on members of the public and occupational workers. During normal facility operations occupational workers would be expected to be exposed to radiological and hazardous materials that are within regulatory limits and the workers would be monitored, if required. Offsite releases are expected to be minimal, but are monitored at release points and reported to the NRC on a semi-annual basis. In addition, doses to the public are estimated on an annual basis. For accident conditions, the hazard may involve releasing higher concentrations of materials over relatively short periods of time (NRC 2007).

3.13.1 Background Radiation Characteristics

Based on the most recent National Council of Radiation Protection and Measurements (NCRP) Report No. 160, I*onizing Radiation Exposure of the Population of the United States* (NCRP 2009), for a U.S. resident, the effective dose per individual from ubiquitous background radiation is 311 mrem/yr (3.11 mSv/yr). The sources of this exposure are naturally occurring

radionuclides, anthropogenic radionuclides (human produced), external radiation, and internal radiation (radionuclides in the body) (NCRP 2009). This value is important to compare to the estimated dose to a member of the public and to the occupational worker from CFFF operations.

The characteristics of background radiation, in terms of average gross alpha contamination, in the vicinity of the CFFF are 3.9×10^{-15} uCi/mL in ambient air, 2.2×10^{-9} uCi/mL in the Congaree River, and 1.0×10^{-9} uCi/mL in offsite well water and drinking water (NRC 1985). The radiological monitoring data of onsite soil resulted in a 3-year average of 0.23 to 0.65 pCi/g of total uranium. The locations of the samples are in the same location as the ambient air monitors (NRC 1985).

3.13.2 Public Health and Safety

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 ground water. According to WEC, the potential contaminants include uranium, ammonia, calcium fluoride, and hydrofluoric acid. WEC conducts a radiological effluent monitoring program to meet the regulatory requirements in 10 CFR 40.65 and 10 CFR 70.59 "Effluent Monitoring Requirements." Data from this monitoring program are used by CFFF to perform annual assessments of dose to members of public from liquid and gaseous effluents to ensure that limits to the public given in 10 CFR 20.1301 are met and are ALARA (WEC 2014b).

The radiological materials potentially released from CFFF into the environment would be transported through the environment in a variety of ways and expose the public through both internal and external exposure pathways. For the liquid exposure pathway, dose to the public would be through ingestion of drinking water and aquatic food, exposure from shoreline activities as well as swimming and boating, and ingestion of irrigated crops. For potential releases to the air, the exposure pathway would include direct radiation from deposited radioactivity on the ground and ingestion of crops and animal products that come in contact with radioactive material in the air.

WEC is required to meet the dose limits for individual members of the public as stated in 10 CFR 20.1301 (see Table 3-7) and demonstrate compliance with the dose limits at the site boundary as required in 10 CFR 20.1302. In addition, WEC demonstrates that offsite doses from the CFFF are ALARA as described in Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities* (NRC 1993).

Table 3-7. Dose Limits for Individuals 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 (0.1mSv/yr) from emissions of airborne radioactive material, excluding radon

3.13.3 Occupational Health and Safety

Occupational workers are exposed to health and safety risks at CFFF, including exposure to industrial hazards, hazardous materials, and radioactive materials. The types of industrial hazards at CFFF are typical of similar industrial facilities and include exposure to chemicals and accidents ranging from minor cuts to industrial machinery accidents. According to the ER, no serious injuries or deaths have occurred at the CFFF site since operations began in 1969 (WEC 2014b).

Health impacts to CFFF workers would be through chronic exposure or improper handling of nonradiological materials including ammonia, nitric acid, nitrates, and hydrofluoric acid. Other less toxic hazardous materials used at CFFF include degreasing solvents, miscellaneous lubricating and cutting oils, and spent plating solutions. The ER states that 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. Use of anhydrous ammonia at 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 2014b).

WEC is required to meet the occupational dose limits for workers as stated in 10 CFR 20.1201 and noted in Table 3-8. Workers are monitored for radiation exposure to ensure the occupational doses limits are met and maintained ALARA.

Table 3-8. Occupational Dose Limits for Adults Established by 10 CFR 20.1201(a)

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) total effective dose equivalent 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 (0.50 Sv/yr) shallow dose equivalent

3.14 Transportation

The CFFF site can be accessed by SC 48 (or Bluff Road). The major transportation corridors in the Columbia area include Interstates I-20 (east-west), I-26 (northwest to southeast), and I-77. Other roads include US-21, US-76/378, and SC 37. See Figure 2-1 for a map of nearby roadways.

The South Carolina Department of Transportation (SCDOT) provides annual average daily traffic (AADT) counts by highway and highway segment. The AADT count in 2016 for SC 48 between Secondary State Highways (S) 87 and S 734 was 4,300 vehicles per day (SCDOT 2016). This portion of the road passes the CFFF site.

CSX Railroad runs two train lines within 8 km (5 mi) of CFFF, but there are no rail lines or spurs on the CFFF site. The closest airport is the Columbia Metropolitan Airport, located 29 km (18 mi) away. The Congaree River supports commercial barge traffic.

There are approximately 1,100 employees at the CFFF working in one of three shifts (WEC 2014b). The annual average daily workforce is 755 workers, and each works approximately 5 days per week for 50 weeks.

WEC approximates 1,342 shipments of chemicals, radioactive material, and waste annually (WEC 2014b). Completed fuel assemblies are shipped to customers in NRC-approved packages. LLW is shipped to NRC- or NRC Agreement State-licensed LLW disposal sites. WEC follows NRC, DOT, and SCDOT requirements for shipment of nuclear materials (WEC 2014b).

4. ENVIRONMENTAL IMPACTS

In this section, the NRC staff presents its evaluation of the potential environmental impacts from continued operation of the CFFF for 40 years. In performing this evaluation, the NRC staff reviewed the WEC's license renewal application including the ER and supplemental information, visited the site, collected information from other State agencies, and considered information presented in previous environmental reviews prepared by the NRC for the CFFF. Mitigation measures as noted by WEC (2014b) are included.

4.1 Land Use Impacts

Under the proposed action, WEC does not expect any new construction or changes to current facility operations or buildings. The use of the land in the surrounding area is not expected to change from its current uses. Therefore, the NRC does not expect any impact on land use as a result of continued operations at CFFF.

4.2 Geology and Soil Impacts

WEC did not propose any facility expansion or other land-disturbing activities to support continued operations for an additional 40 years. Therefore, no new construction or changes in operations are expected to affect the geology and soil at CFFF.

As noted in Section 3.2, there has been soil contamination from VOCs, inorganics, and radiological contaminants. Contaminants can leach from the subsurface soil and migrate with the ground water (AECOM 2014). The concentration of uranium in the surface soil has slightly increased from less than 1 pCi/g in the late 1970s to 2–4 pCi/g in 2015. Uranium in the surface soil, most likely from deposition of gaseous effluents, would continue through the license renewal period and has the potential to increase the concentration of uranium in the surface soil and potentially ground water through infiltration of rainwater. WEC has initiated an effort to collect surface soil samples from the entire CFFF site to gather additional data on radionuclide concentrations in the surface soil (NRC 2017a). For purposes of decommissioning, NRC (2006) guidance provides surface soil screening values for common uranium isotopes that range from 8 to 14 pCi/g, which would be deemed in compliance with the 25 mrem/yr unrestricted dose limit in 10 CFR 20.1402.

As discussed in Section 3.2, a 2011 pipe leak resulted in uranium being released to the subsurface and into the environment. Because the contaminated material is located beneath the URRS building, the soil will not be remediated until decommissioning. Therefore, the contaminated material will likely be a source of future ground-water and/or surface water contamination if the material leaches into the shallow water-table aquifer. A sediment sample collected in 2013 showed elevated levels of gross alpha compared to the other samples. This could indicate that the contamination from the pipe leak has moved through the soil and or ground water and intersected with surface water and soil in the ditches. WEC has committed to taking a soil sample at a location west of the leak area to help monitor whether contaminants migrate into the ground water and beyond the URRS area. The impacts of the 2011 pipe leak on ground water are addressed in Section 4.4.

Results from ongoing monitoring and site investigations will help WEC develop mitigative or corrective actions, if needed, to address the impacts of past leaks or spills on the soil. The NRC will continue its oversight and inspection activities at CFFF, including the environmental monitoring program. WEC must also consider contamination, including subsurface contamination involving residual radioactivity, when planning for decommissioning including ensuring adequate funding to cover remediation efforts. Therefore, with ongoing monitoring, NRC oversight, and decommissioning planning, the NRC does not expect significant impacts on soil as a result of continued operations at CFFF.

4.3 Surface Water Impacts

In this section, the NRC considers potential impacts on both the use and quality of surface water as a result of CFFF's continued operations.

4.3.1 Surface Water Use

As noted in Section 3.3, WEC gets its service water from the City of Columbia, which takes water from the Congaree River. WEC discharges its treated liquid effluent directly into the Congaree River in accordance with its NPDES permit. WEC does not use any onsite surface water. The renewal of the CFFF operating license for an additional 40 years does not involve changes to current operating practices, including expected water usage or discharge amounts. Therefore, the NRC does not expect any impact on the consumption of surface water during the license renewal period.

4.3.2 Surface Water Quality

4.3.2.1 Congaree River

Potential impacts on water quality of the Congaree River include those related to the continued discharge of liquid effluents directly into the river. The content and amount of liquid effluent to be discharged into the river would be similar to current discharges. WEC would continue to be governed by its NPDES permit for discharge into the Congaree River and the NRC expects that WEC would comply with the conditions set forth in that NPDES permit. WEC has submitted a timely renewal application for its NPDES discharge permit and SCDHEC is currently reviewing the application (WEC 2017d). The NPDES permit must be renewed every five years and therefore the conditions in the permit could be adjusted as necessary.

4.3.2.2 Onsite Surface Water

Onsite surface water bodies include Mill Creek, Sunset Lake, and Gator Pond. Onsite surface water is not a source of drinking water. WEC has a NPDES permit for stormwater. Surface water and stormwater drainage is released through a single outfall, which is attenuated by its movement through Mill Creek and Sunset Lake before reaching the Congaree River. It is possible that contamination present in the onsite surface water—Mill Creek and Sunset Lake—could eventually empty into the Congaree River. The large volume of Sunset Lake and its slow discharge should attenuate contaminant discharges into Sunset Lake making them relatively small.

WEC has a sampling and monitoring program for surface water to meet its NRC license requirements (summarized in Section 2.4.3). The monitoring program previously required three surface water samples to be taken quarterly and analyzed for gross alpha and gross beta (WEC 2007). However, going forward, WEC will sample six surface water locations (see Figure 2-5) as part of its NRC license commitments to better monitor for migration of existing contamination or new unintended abnormal releases. Surface water sampling results between 2011 and 2015 showed that concentrations have potentially met or exceeded the gross alpha standard of 15 pCi/L at the "roadway" sampling location, which is collected near the WWTP facility (NRC 2017a). WEC has added investigation limits for surface water that, if triggered, would require further isotopic analysis/gamma/beta analysis. If, after the isotopic analysis, sample results exceed the action level for contaminants, then WEC would develop an action plan to be included in the CAP.

Future episodes of significant rainfall such as the rain event in October 2015, could again cause the lagoons to overflow, allowing for an uncontrolled release of their contents into nearby surface water bodies. However, the NRC expects that similar to the October 2015 event, WEC would notify SCDHEC of such an event and if needed, SCDHEC could require immediate corrective actions. Any notification to SCHDEC as a result of a NPDES violation would also require WEC to inform the NRC (WEC 2018a).

WEC also added two additional sediment collection points from within Sunset Lake and Gator Pond. This new annual sampling requirement will help demonstrate whether any contaminants are potentially accumulating in Sunset Lake or Gator Pond, into which shallow ground water discharges.

WEC is expected to continue to comply with its NPDES permit requirements for storm water as regulated by the SCDHEC. 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. If certain levels are reached, WEC would develop corrective actions to address the contamination. The NRC will continue to inspect WEC's environmental monitoring program. Therefore, the NRC expects that although there is existing surface water contamination onsite at CFFF, potential impacts on surface water quality as a result of continued operations at CFFF could be noticeable but not significant.

4.4 Ground-water Impacts

The NRC as part of its analysis of the impacts on ground water, considers the potential impacts on the consumption of and quality of ground water.

4.4.1 Ground-water Use

WEC does not currently use ground water nor are there any plans to use ground water in the future; therefore, there are no potential impacts from consumptive use of ground water.

4.4.2 Ground-water Quality

As described in Section 3.4, the ground water has been contaminated with VOCs, inorganics, gross alpha, gross beta, uranium, and Tc-99 from past activities, including spills and leaks. The

ground water at the CFFF site is classified by South Carolina as a source of drinking water, even though it is not currently being used as a source of drinking water by WEC.

4.4.2.1 Nonradiological Contaminants

Volatile Organic Compounds

The source of the VOC contamination, the former oil house, has been removed. Currently, the VOC plume is within the boundaries of the CFFF property. Further, WEC has entered into a cleanup contract with SCDHEC to address sVOCs in the ground water (SCDHEC/WEC 2016). The NRC expects that WEC will comply with any requirements established by the cleanup contract with SCDHEC. Therefore, the NRC acknowledges the ground water is contaminated with VOCs, but does not expect the impacts on ground water to be significant because WEC is taking corrective actions as required by SCDHEC.

Inorganics

Concentrations of nitrate and fluoride exceed their respective MCLs and ammonia concentrations are still elevated. The ground-water data indicate that the plumes remain within the boundaries of the CFFF property, primarily around the WWTP and Gator Pond area. Four out of the six WWTP lagoons, which WEC determined was the sources of the inorganics, have been relined. Based on previous experience with the performance of the lagoon liners, there is the potential that the lagoons will have to be relined within the license renewal period. Further, the NPDES permit requires sampling for nitrates and fluorides and therefore, if necessary, SCDHEC could require corrective actions to address fluorides and nitrates. The NRC acknowledges the ground water is contaminated with inorganics, but because the contamination has not reached offsite and there is no current pathway for exposure, and because WEC would have to comply with any SCDHEC requirements, the NRC expects the impacts on ground water from inorganics to be noticeable but not significant.

4.4.2.2 Radiological Contaminants

Past operations have resulted in abnormal leaks and spills, such as the overfilling of a cylinder that resulted in the release of Tc-99 to the environment and the 2011 pipe leak that resulted in an unknown quantity of uranium being released into the soil. The WWTP has been a continual source of ground-water contamination. Therefore, the NRC finds it likely that during the 40-year license renewal period the liners will need to be replaced again.

Section 3.4 discussed the gross alpha and gross beta contamination in the ground water. WEC performed a plume analysis and monitoring sufficiency review in 2016-2017 using historical data collected from all monitoring wells. The most recent plume analysis performed by WEC did not show a gross alpha plume. WEC's position is that gross alpha contamination found in ground water samples appears to be random and more characteristic of naturally occurring radionuclides (NRC 2017a). Although the gross beta concentrations currently exceed WEC's 50 pCi/L investigation level, isotopic analysis has shown that the Tc-99 concentrations are well below the 900 pCi/L MCL.

At this time, the ground-water contamination is onsite and has not migrated offsite. Further, there is no current pathway scenario for exposure to the public because there are no onsite drinking water wells, and no drinking water wells between the site and the Congaree River which is in the direction of the ground-water flow.

The monitoring data indicate the contamination is only present in the shallow water-table aquifer. Data from the three deep Black Mingo aquifer wells do not indicate the presence of any contamination. Although the deeper Black Mingo aquifer is likely confined, ground water level data indicated that both upward and downward gradients may exist between the shallow aquifer and the Black Mingo aquifer within the CFFF property. The likelihood of water, and potentially contaminant, exchange is relatively small but cannot be completely ruled out.

The SCDHEC is requiring ongoing ground-water monitoring as part of WEC's NPDES permit requirements, including monitoring of gross alpha and gross beta. WEC reports the results to SCDHEC annually. Based on results of the annual sampling or during a NPDES renewal review, SCDHEC could adjust monitoring requirements if deemed necessary, including requiring additional assessment.

WEC's ground-water monitoring program required for its NRC license will include sampling 25 ground-water wells, twice a year during both the wet and dry seasons. The monitoring network of ground-water wells will help WEC track the migration of known contamination and will help identify any increasing trends. The ground-water monitoring network will also provide early detection of any abnormal releases, thereby providing information for mitigation and corrective action decisions. WEC has also added action levels, equivalent to State and Federal regulatory limits (i.e., EPA's drinking water standards), which, if exceeded, will trigger WEC to develop an action plan that will be included in its CAP. SCDHEC stated in its March 22, 2018, letter, the ground water is classified "GB" which means the ground water is a current or potential source of drinking water, therefore, the ground water must meet the MCLs established in the State's primary drinking water regulations (R.61-58) (SCDHEC 2018a). The NRC has added a license condition that requires WEC to develop an action plan, documented in its CAP, if those action levels are exceeded.

The NRC, through continued oversight and inspection will ensure WEC complies with its environmental monitoring program, documented in Chapter 10 of its license renewal application. To meet the criteria for unrestricted release, WEC must clean up the site to meet the public dose standard in 10 CFR 20.1402 (less than 25 mrem/yr), including dose from ground water. WEC must also consider the volume of onsite subsurface material containing residual radioactivity that will require remediation when it is preparing its detailed cost estimate in the DFP for NRC review and approval.

The NRC acknowledges existing ground-water contamination onsite at CFFF above EPA's drinking water standards. However, because (1) the ground-water contamination remains onsite, (2) there is no pathway for human consumption of the ground water, (3) there is ongoing monitoring as part of SCDHEC and NRC requirements, (4) there is a lack of contamination thus far of the deeper Black Mingo aquifer, (5) WEC has committed to developing a corrective action plan if action levels are triggered, and (6) because WEC must maintain sufficient funds to

decommission the site, the potential impacts on ground-water quality as a result of continued operations at CFFF are noticeable but if monitored properly are not expected to be significant.

4.5 Ecological Resources

During continued operations, impacts on ecological resources could result from elevated noise levels from daily operational activities and increased turbidity or introduction of pollutants from site runoff and discharges. Disturbance from daily activities or elevated noise levels are likely to have minimal impacts on wildlife, given that the species closest to the developed areas of the site are generally tolerant of human disturbances because the facility has been in operation for the past several decades. In response to any disturbances, birds and wildlife could move out of the immediate area and find an adequate, similar habitat within the vicinity. In addition, no ground-disturbing activities would occur within undisturbed portions of the CFFF site.

Operation of the CFFF would result in some degradation of aquatic habitats due to direct impacts (e.g., effluent discharges into the Congaree River) and indirect impacts from site run off. Direct impacts from the discharge of effluents into the Congaree River would be limited due to the chemical and quantity limits described in the NPDES permit (WEC 2014b), to which CFFF must adhere. In addition, 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 quickly dissipate. 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 while moving through the effluent plume would likely 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 WEC would not directly obtain water from surface water bodies.

Indirect impacts on aquatic habitats and biota during operations could include runoff that may contain sediments, contaminants from road and parking surfaces, or herbicides. However, impacts 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.

Continued operation of the CFFF could have beneficial impacts for some wildlife. WEC volunteered to participate in the Wildlife and Industry Together program, which is sponsored by South Carolina Wildlife Federation (SCWF 2017). Members of the program establish conservation and education goals to improve wildlife health (WEC 2014b). To become certified, WEC agreed to conduct wildlife habitat enhancement projects on or near the CFFF site, environmental education for employees, and community outreach.

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 continued operations would not be significant.

4.6 Special Status Species and Habitats

Section 3.6 describes the seven Federally listed species that may occur near the CFFF. Six of the seven 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 NRC's determination that impacts on Federally listed protected species at the CFFF were unlikely (NRC 2015d). In a letter dated May 20, 2015, FWS concurred with the NRC's determination that the proposed activity is not likely to adversely affect the Federally listed species under FWS's jurisdiction (FWS 2015).

One of the Federally listed species—the Shortnose Sturgeon—is under NMFS jurisdiction. On August 16, 2017, the NRC submitted a Biological Evaluation to the Southeast Regional Office of NMFS (NRC 2017b). In its evaluation, the NRC 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. NMFS (2017a, b) submitted several questions to the NRC related to the project and potential impacts on the Shortnose Sturgeon so the NRC provided supplemental information (NRC 2018a, 2017c, d, e). NMFS responded on April 12, 2018, with its concurrence on the NRC's determination regarding the Shortnose Sturgeon (NMFS 2018).

4.7 Air Quality

Under the proposed action, there would be no new construction or change in operations. WEC would continue to comply with permit limits for criteria pollutants, 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 attainment area for the NAAQSs. The proposed action does not involve changes to equipment operations, workforce size, or truck shipments.

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 (74 FR 56260). In general, the threshold for reporting is 25,000 tons carbon dioxide equivalent (CO^2eq) emissions per year, excluding mobile-source emissions. On May 13, 2010, the EPA issued the GHG Tailoring Rule. This rule set the thresholds for a phase-in approach to regulating GHG emissions under the prevention of significant deterioration (PSD) and Title V permitting programs (75 FR 31514). Beginning on January 2, 2011, operating permits issued to major sources of GHGs under the PSD or Title V Federal permit programs must contain provisions requiring the use of best available control technology to limit the emissions of GHGs, if those sources would be subject to PSD or Title V permitting requirements because of their non-GHG pollutant emission potentials and if their estimated GHG emissions are at least 75,000 tons/yr of CO^2eq.

Based on its review of previous large construction and operation projects that did not reach these thresholds, the NRC staff estimates that the GHG emissions from the proposed continued operation of CFFF would be below the 25,000 tons/yr threshold and would not be significant.

WEC would also continue its sampling and monitoring program to ensure radiological emissions meet 10 CFR Part 20 limits. The program includes 47 stacks as well as 4 onsite locations monitored for the presence of radioactive material.

As discussed in Section 3.7 of this EA, climate change impacts for the Southeast include increasing temperatures and increases in the frequency and intensity of extreme precipitation. Increases of 4°F to 8°F in the annual average temperature are projected for the Southeast (GCRP 2014). In a higher temperature environment, the formation of ozone due to emissions of nitrogen oxides from onsite equipment may increase. However, air emissions due to equipment operation are localized and temporary and unlikely to contribute measurably to ozone formation. Therefore, the NRC expects that the impacts on air quality from continued operation at the CFFF would be minor.

4.8 Noise

Under the proposed action, WEC does not plan any new construction or any changes to the CFFF operations. Given the distance of the CFFF from the site boundary, noise from CFFF operations is not detectable at the boundary. Therefore, the NRC expects that there would be no noticeable impacts due to noise as a result of continued operation.

4.9 Historic and Cultural Resources

Under the proposed action, WEC does not plan for any new construction or any changes in the current operations. The Denley Cemetery is currently maintained by WEC and it is expected that WEC will continue its upkeep.

The South Carolina SHPO (SCAHC 2015) concurred on the NRC's no effect determination (NRC 2015b). Details on the National Historic Preservation Act of 1966 (NHPA) Section 106 consultation are provided in Section 6.1.

The NRC (2015d) staff contacted the Catawba Nation about its no effect determination but has not received a response. As noted in the 2007 EA, if WEC does future work that requires NRC approval, then the NRC would evaluate the potential impacts of that activity on historic and cultural properties. WEC's Environmental Protection Guidelines and Checklist was modified to include considerations for archaeological or historical sites when doing new onsite work (NRC 2017a).

WEC has not indicated any new NRC-authorized construction or land disturbance as part of its license renewal application; therefore, the NRC does not expect any impact on historic and cultural resources from the continued operation of the CFFF.

4.10 Visual and Scenic Resources

The CFFF is an existing facility set back from Bluff Road. Under the proposed action, no new construction would take place nor are changes planned for existing structures. The CFFF would be the same in appearance throughout the proposed 40-year license period. Therefore, no impacts on visual and scenic resources are expected as a result of continued operation.

4.11 Socioeconomics

The proposed action of license renewal does not involve any changes in operations or staffing levels. Tax revenue from the CFFF would remain the same; as such, there would be no changes in benefits or changes in public services as a result of the proposed action. With staffing levels remaining the same, there would be no impact on housing availability in the county. Therefore, no impact on socioeconomics in Richland County would be expected as a result of CFFF continuing to operate for an additional 40 years.

4.12 Environmental Justice

The proposed action would not cause noticeable impacts on populations living in the vicinity of the CFFF. Because the proposed action would not cause noticeable impact on any population, there are no disproportionately high and adverse human health and environmental effects on minority or low-income populations that could result from activities associated with the continued operation of the CFFF.

4.13 Public and Occupational Health

The renewal of the CFFF operating license for an additional 40 years does not involve changes in current operating practices; therefore, changes in public and occupational health are not expected. The dose to members of the public and workers would continue and WEC would continue to comply with license and regulatory requirements.

4.13.1 Impacts on Public Health

WEC reports the results of the stack releases and Congaree River discharges to the NRC semi-annually. These reports include the estimated source terms and activity for radiological effluents (based on sampling results) and uses them to calculate inhalation and ingestion doses. Assessment of estimated radiological doses to the public from the CFFF operations were reviewed and compared to regulatory limits given in 10 CFR 20.1301 for the years 2014 through 2016. Data were obtained from the Annual Assessment of Public Doses from Liquid and Gaseous Effluents, required to be submitted annually (WEC 2015b, 2016b, 2017c). For all 3 years, the whole body dose to a member of the public (modeled at the nearest site boundary) was 0.16 mrem/yr (1.6×10^{-3} mSv) and was primarily from the air emissions, direct inhalation. 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. This is approximately 1.6 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), the 0.16 mrem/yr is only a small fraction of that amount.

Based on this review, and the continued requirement to meet NRC dose limits to the public, NRC does not expect a noticeable impact on members of the public from renewing the CFFF license for an additional 40 years.

4.13.2 Impacts on Occupational Workers

According to WEC, from 2005 to 2011, the average annual total effective dose to the occupational worker from the combined effluent releases ranged between 197 mrem (1.97×10^{-3} mSv) (0.197 rem) and 3.27×10^{-3} mSv (0.327 rem) (WEC 2014b). The average worker dose in 2014 was 199 mrem (1.99×10^{-3} mSv) (NRC 2016e). These doses are less than 10 percent of the 5.0 rem annual occupational dose limits in 10 CFR 20.1201. Through 2014 (the most recent data available), no individual radiation worker had an annual total effective dose above this limit (NRC 2016e; WEC 2014b).

From this review, and the continued requirement to meet NRC dose limits to occupational workers, the NRC does not expect a noticeable impact on occupational workers from renewing the CFFF license for an additional 40 years. The NRC is performing a safety review of CFFF (documented in a separate SER) that will include detailed radiation safety analyses.

4.14 Transportation

The proposed action does not involve any increase in workforce size or additional material 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 expects any transportation impacts as a result of continued operation to be minor.

4.15 Waste Management

Section 2.3 provides a description of the types and amounts of waste generated and how they are managed. The proposed action would allow CFFF to operate for another 40 years and thus WEC would continue to generate and dispose of waste. Waste types include gaseous and liquid effluents and solid wastes. This section describes the potential impacts associated with solid waste generation and management. The potential impacts associated with liquid effluents and air emissions are discussed in Sections 4.3 and 4.7, respectively.

Sufficient capacity exists at available LLW, hazardous, and nonhazardous waste treatment and disposal facilities for the waste volumes generated at the CFFF. In addition, waste minimization practices are in place at CFFF and are expected to continue under the proposed action. These practices involve waste reduction, reuse, and recycling.

The NRC expects that WEC will follow all applicable State and Federal regulations as they indicated in their license renewal application and ER (WEC 2014b). The LLW is shipped in DOT-approved packages. Waste shipments are made in compliance with applicable State and Federal regulations (WEC 2014b)

Under the proposed action, WEC does not plan any changes in the CFFF operations. The NRC expects that waste generation and management over the license renewal period would be similar to current generation rates and management practices. Thus, the associated impacts would also continue to be similar to impacts observed to date and would not be significant.

The Barnwell LLW facility is expected to close in 2038, after which time the CFFF would need to ship its LLW to another facility. The NRC assumes that sufficient LLW disposal capacity will be available when needed. For example, the opening in 2012 of the Waste Control Specialists LLW facility in Andrews County, Texas, demonstrates an instance of private industry meeting the current demand (NRC 2014).

4.16 Accidents

The term "accident," as used in this section, refers to any off-normal event that results in the release of radioactive and nonradioactive 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, and regulations that apply to the control of radiological and non-radiological risks from accidents are also in 10 CFR Part 70.

Subpart H of 10 CFR Part 70, 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 evaluates compliance with the performance requirements in 10 CFR 70.61, 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 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). WEC performed an ISA and submitted a summary to the NRC for review as part of the license renewal review (WEC 2018a).

The purpose of the NRC'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, using methods and qualified staff adequate to achieve the requirements of 10 CFR 70.62; identified and evaluated all credible events (accident

Radiological and Non-Radiological Risk Regulations

As noted in NUREG-1520 (NRC 2010), 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.

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 70; 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 summary are incorporated into the license (NRC 2010).

The NRC staff assessed the potential environmental impacts of postulated accidents (radiological and nonradiological) taking into consideration the information provided in the WEC's ER (WEC 2014b). In its ER, WEC relied, in part, upon the NRC's evaluation of accidents presented in the 1985 EA. The NRC staff also considered the publicly available information in WEC's ISA Summary submitted as part of its license renewal application (WEC 2018a).

In its ER, WEC identified the following accidents with bounding maximum consequences: criticality accidents and radioactive and chemical releases from a UF_6 cylinder. Both chemical and radioactive materials are present in the fuel fabrication operations at the CFFF. The exposure and hazards from these materials are discussed in the ISA performed for the facility.

As discussed in the ER (WEC 2014b), the bounding maximum consequence basis accidents for the CFFF are as follows:

- 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.

In Chapter 4 of its license application, 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 4.2 of Chapter 4 of the license application identifies WEC's accident consequence levels implemented for complying with the performance requirements in 10 CFR 70.61 (WEC 2018a).

The NRC staff, as part of its safety review of the license renewal application, will make the determination of whether the IROFSs are available and reliable to reduce the likelihood of occurrence and consequences of the 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 will determine if WEC has committed to an acceptable radiation protection program that meets requirements set forth in 10 CFR Parts 19, 20, and 70. Conformance to the license application and license conditions will help ensure safe operation of the CFFF.

4.16.1 Radiological Accidents

WEC discussed a UF_6 release from shipping cylinders stored inside the manufacturing building and in the outside storage area. UF_6 is solid at ambient temperatures and sublimes to a gas (at 56°C [132°F]). If released, the gas can react with water vapor in the air to form hydrofluoric acid (HF), a very corrosive acid, and a uranyl fluoride (UO_2F_2), a soluble form of uranium. Because UF_6 is a solid at ambient temperatures, WEC described the release of UF_6 from cylinders stored outside as extremely remote. WEC further explained that if a cylinder containing solid UF_6 were to fail, the quantity of material released would not contribute significantly to the plant's emissions from normal operations, because UF_6 would not vaporize as quickly and the UO_2F_2 that would be formed would be a solid that would further reduce the rate of release.

WEC, however, considered a large release of UF_6 in the UF_6 outside storage area as a credible event as a result of a fire caused by a truck crashing and rupturing a UF_6 cylinder. The UF_6 would sublime and form HF and UO_2F_2. WEC estimated that the average concentration of uranium and HF at the nearest residence from the plume, assuming F-type atmospheric stability, wind speed at 1 m/s, ground release, and building wake effect, would be about 60 mg/m^3 and 20 mg/m^3, respectively. WEC estimated the intake of soluble uranium of an individual standing at the plume for an entire hour to be approximately 50 mg. WEC's ISA methodology defines a high-consequence event as one with greater than or equal to 100 rem dose equivalent, emergency response planning guideline (ERPG-3) chemical exposure, and/or 400 mg of soluble uranium intake to a worker, and greater than or equal to a 25 rem dose equivalent, ERPG-2 chemical exposure and/or 30 mg soluble uranium intake to the offsite public (WEC 2018a). ERPG[4] values for HF are 2 ppm (ERPG-1), 20 ppm (ERPG-2), and 50 ppm (ERPG-3). NRC Interim Staff Guidance (ISG)–14 (NRC 2015e) notes that a renal concentration of approximately 50 µg U/g kidney or more would result in a high-consequence exposure event as defined in 10 CFR 70.61(b)(4) and a renal concentration approximately 18 µg U/g kidney could result in an intermediate consequence. Using conversion factors and rounding, the ISG–14 identifies 400 mg as the uranium intake quantity associated with a high-consequence event and 150 mg for an intermediate-consequence event for a worker.

[4] Emergency response planning guidelines developed by American Industrial Hygiene Association (2013).
ERPG-1: the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing anything other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.
ERPG-2: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.
ERPG-3: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

WEC (2014b) described the following characteristics of and assumptions for a criticality accident at the CFFF:

- 10^{19} fissions are produced in a series of pulses within a supercritical liquid system over an 8-hour period.
- Volatile fission products are released and radioactive decay begins.
- 25 percent of the halogens and 100 percent of the noble gases are released from the manufacturing building.
- Atmospheric conditions feature F-type atmospheric stability, wind speed at 1 m/s, and building wake effect.

WEC estimated that the offsite consequences (at the nearest residence) from this accident would be within regulatory limits (WEC 2014b).

WEC also evaluated a major fire that would completely burn the HEPA filters used for the conversion and scrap recovery processes. HEPA filters with an efficiency of 99.97 percent for >0.3-µm-diameter particles are used for removing particulate uranium. These filters are located on the roof of the manufacturing building. WEC estimated that the maximum uranium activity accumulated in these filters would be 1.4 Ci (based on 26 weeks between filter changes). Using the same atmospheric conditions considered for the UF_6 release and criticality accidents, WEC estimated the average uranium concentration at the nearest residence would be 9.1×10^{-5} µCi/m^3. WEC assumed an individual exposed to the plume for 1 hour would receive an effective whole body dose commitment of about 9×10^{-3} rem (WEC 2014b)

Therefore, the NRC staff concludes that the environmental impact of a UF_6 release could be significant if no controls are implemented to prevent or mitigate the consequences. However, WEC has identified IROFSs through the ISA process and has implemented these controls at the CFFF to reduce the likelihood of occurrence of the event or mitigate the consequences to levels in accordance with the 10 CFR 70.61 performance requirements.

In 2016, while conducting an annual inspection and cleaning a scrubber, WEC found a large mass of material inside the scrubber inlet transition. WEC believed that the material was low in uranium content, but upon further analysis WEC found that the uranium mass limit was exceeded. WEC reported the event to the NRC on July 14, 2016 (EN #52090). On July 31, 2016, 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. 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 WEC on October 26, 2016 (NRC 2016f). The AIT found that IROFSs for the scrubber did not ensure that a criticality accident was highly unlikely and that the controls and measures to protect against a criticality were not sufficient to assure subcriticality conditions. The AIT also found that WEC did not establish adequate management measures to ensure the availability and reliability of the IROFS and that 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 2016f).

On August 9, 2016, WEC provided its commitments to NRC addressing the actions to be taken to identify the causes of the event and corrective actions (WEC 2016c). The NRC issued a Confirmatory Action Letter (CAL) on August 11, 2016 (NRC 2016g) to confirm 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 WEC's ability to safely operate the facility (NRC 2016h). By letter dated October 20, 2017, the NRC staff informed WEC that there were no issues with the licensee's plan to restart the conversion process equipment and scrubber (NRC 2017f). The NRC staff clarified, however, that NRC's written consent for restart was not intended to reflect or suggest that the CAL was closed; additional NRC inspections will continue until all remaining CAL items are completed.

4.16.2 Nonradiological Accidents

WEC discussed nonradiological accidents in its ER, which in part, is based on the NRC 1985 EA prepared for WEC's renewal of its license. These potential accidents could include minor liquid spills of acids, ADU, uranyl nitrate, and oil in the manufacturing building. Minor spills are defined as less than 40 L (10 gal) (WEC 2014b). The chemical processing building does not have floor drains, which prevents liquid releases to the environment. Such spills could also affect operators, but WEC explained that operators would detect these spills and take appropriate corrective and cleanup actions. Spills that could cause a release to the environment (soil and ground water) could result from a leak in the liner of a waste-holding lagoon. A rupture of a tank in the outside chemical storage areas could also lead to a liquid release to the environment. WEC, however, indicated safety systems (e.g., dikes) are available to manage such events. Airborne releases due to the vapors from chemicals could lead to offsite exposure. Controls are in place to manage such releases.

5. CUMULATIVE IMPACTS

Cumulative effects are defined as "the impact on the environment that results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). The potential impacts from the proposed action are discussed in the preceding sections of this EA.

Since the 2007 EA was published, WEC has made some changes to its operations, which are discussed in Section 2.2.1. For example, the installation of a concrete pad for auxiliary UF_6 storage. Although WEC was able to install the concrete pad without prior NRC approval, the NRC did conduct a safety review for the storage of additional UF_6 cylinders on the pad and determined a categorical exclusion was appropriate, and thus the action did not individually or cumulatively have a significant effect on the environment (NRC 2015a).

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. Transportation due to logging operations is negligible compared to the CFFF's 1,100 employees already commuting daily to the site. Dominion is installing a natural gas pipeline along Bluff Road that will be within 1,100 ft northwest of the CFFF site. An EA was prepared for the pipeline that indicated the impacts would not be significant for this particular portion of the route and that impacts on ground-water resources would be minor and temporary (FERC 2016).

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.

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 will 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) and for the southern or "lower" part of the county (Lower Richland Community 2014) have recently been issued. The county-wide document provides guidance relative 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 will not change over the assessed upcoming 20 years (Richland County 2015). 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 (Lower

Richland Community 2014). Within 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 planned and land clearing for it has already started (SCDOC 2016).

On the north side of Bluff Road, there is a 4-ac Superfund site—South Carolina Recycling and Disposal, Inc. The site was used for storage, recycling, and disposal operations until 1982. The site has contaminated ground water and soil, primarily from VOCs, resulting from past activities. According to the EPA, the migration of contaminated ground water 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 2017). However, WEC claims it has identified surface water from the Superfund site reaching the CFFF property through ditches that run along the east side of the facility. However, WEC indicated no concern about contaminant contribution from the Superfund site at this time (NRC 2017a). But there is the potential for cumulative effects on surface water or ground water if contamination at the Superfund site were to migrate offsite onto the CFFF property.

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 WEC's plans for site decontamination and decommissioning as well as the amount of funding needed for decommissioning.

Other facilities within a 50-mi radius of the site produce and may release radiological materials to the environment. These facilities include the decommissioned Carolinas-Virginia Tube Reactor and hospitals that may be using medical isotopes. Based on the low levels of radiation exposure from these facilities and the distance to CFFF, the NRC does not expect these facilities would noticeably contribute to the cumulative radiological impacts from CFFF's continued operation.

In the future, it is possible that WEC could undertake activities that do not require prior NRC approval under 10 CFR 70.72, which could potentially result in new construction or land disturbance, such as new concrete storage pads or onsite landowners changing the current use of the land (agricultural, logging). For some requests, WEC might need a license amendment, in which case the NRC would then evaluate the potential environmental impacts of that action.

Once operations have ceased, the CFFF will be decommissioned. Although there are no specific plans for decommissioning at this time, activities associated with decommissioning would cause impacts on the environment. Potential impacts include increased generation of waste, increased traffic due to transport of waste and debris offsite, noise and dust from demolition, effects on tax revenue and employment levels, and changes in occupational and public radiation doses.

The NRC staff has assessed the potential incremental impacts of the proposed action in consideration with the current and reasonably foreseeable activities discussed above and has determined that there would be no significant cumulative impacts based on the incremental impacts from the proposed action.

6. AGENCIES AND PERSONS CONSULTED

The NRC and SCDHEC discussed the NRC's license renewal review as well as SCDHEC's ongoing reviews related to the CFFF site (NRC 2018c). The NRC sent the draft EA to SCDHEC for a 30-day review and comment period (NRC 2018d). On April 27, 2018, SCDHEC responded that its comments were represented in its March 22, 2018, letter which stated that ground water at CFFF must meet the State's primary drinking water regulations in R.61-68 (SCHDEC 2018b). The NRC added a license condition that an action must be taken by WEC, and documented in the CAP, if ground-water or surface water sampling results indicate uranium or Tc-99 exceed their respective drinking water standards.

6.1 NHPA Section 106 Consultation

On May 12, 2015, the NRC staff requested the Catawba Indian Nation's concurrence on its determination that historic and cultural resources at the CFFF would not be adversely affected by the proposed 40-year licensing renewal (NRC 2015c). The Catawba Indian Nation did not respond.

On May 12, 2015, the NRC staff issued its determination that no historic and cultural resources would be affected by the proposed 40-year licensing renewal to the South Carolina SHPO (NRC 2015b). On May 28, 2015, the South Carolina SHPO concurred with the NRC's determination that no properties listed in or eligible for listing in the NRHP will be affected by the proposed action (SCAHC 2015).

6.2 ESA Section 7 Consultation

Section 3.6 describes the Federally listed species that may occur near the CFFF. Six of the seven 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 NRC's determination that impacts on Federally listed protected species at the CFFF *may affect, but are not likely to adversely affect* Federally listed species (NRC 2015d). In a letter dated May 20, 2015, FWS concurred with the NRC's determination that the proposed activity *may affect, but is not likely to adversely affect* the six Federally listed species under FWS's jurisdiction (FWS 2015).

6.3 NMFS Consultation

One of the Federally listed species—the Shortnose Sturgeon—is under NMFS jurisdiction. Section 3.6 provides information about the sturgeon. On August 15, 2017, the NRC submitted a Biological Evaluation to the Southeast Regional Office of NMFS with the NRC's determination that license renewal *may affect, but is not likely to adversely affect* the Shortnose Sturgeon (NRC 2017b). NMFS requested additional information from the NRC regarding the project so the NRC submitted supplemental information (NRC 2018a; 2017c, d, e). On April 12, 2018, NMFS responded with their concurrence on the NRC's determination (NMFS 2018).

7. CONCLUSION

Based on its review documented in this EA, the NRC staff has determined that the proposed action—renewal of license SNM-1107 authorizing continued operations at WEC's CFFF in Richland County, SC for a period of 40 years—will noticeably, but not significantly, affect the quality of the human environment. During the license renewal review, WEC modified its monitoring program as documented in its license renewal application, specifically Chapter 10 (WEC 2018a).

- In its license renewal request, WEC is not proposing changes in authorized operations or any new construction or land disturbance, and therefore, no impacts on land use, historic or cultural resources, visual resources, or socioeconomics are expected.
- The NRC determined there would be no disproportionately high and adverse human health and environmental effects on minority or low-income populations.
- Impacts on ecological resources, air quality, public and occupational health, transportation, and waste management from continued operation of the CFFF would be similar to those occurring now and are not expected to be significant.
- FWS concurred with the NRC's determination that license renewal may affect, but is unlikely to affect, special status species and habitat under its jurisdiction. NMFS concurred with the NRC's determination that license renewal may affect, but is unlikely to affect, the Shortnose Sturgeon.
- Existing ground-water contamination onsite has not migrated into the deeper Black Mingo aquifer or offsite.
- WEC is monitoring and sampling multiple ground-water wells as part of its NRC license and SCDHEC NPDES permit.
- WEC's environmental monitoring program will continue to provide information about existing contamination and help identify future unintended releases into the environment. As needed, corrective actions could be implemented to address the impacts of such releases. The NRC has added a license condition to ensure WEC develops action plans as part of its CAP.
- NRC expects that WEC will continue to meet all local, State, and Federal requirements, including its NPDES permit requirements and VCC obligations with SCDHEC.

Therefore, based on this assessment, in accordance with 10 CFR 51.31, preparation of an EIS is not required for the proposed action, and pursuant to 10 CFR 51.32, a Finding of No Significant Impact is appropriate.

8. LIST OF PREPARERS

NRC staff from the Offices of Nuclear Material Safety and Safeguards, New Reactors, Nuclear Regulatory Research, and Nuclear Reactor Regulation assisted in the preparation and review of this EA. The names of the staff and the resources they evaluated are listed below.

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Other contributors, no longer with the NRC, include John Fringer, Asimios Malliakos, and Stephen Lemont.

9. REFERENCES

References used in the preparation of this EA are available for public review through the NRC's electronic reading room (ADAMS [Agencywide Documents Access and Management System]) at http://www.nrc.gov/reading-rm/adams.html. To begin the search, select "Begin Web-Based ADAMS Search." The ADAMS accession numbers are provided for all references. The references are also available for public inspection and copying at NRC's Public Document Room, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852. For those references available online, a web address is provided.

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