4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

The environmental report must include an analysis that considers . . . the environmental effects of the proposed action . . . and alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The environmental report shall . . . discuss . . . the impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance. [10 CFR 51.45(b)(1)]

The information submitted . . . should not be confined to information supporting the proposed action but should also include adverse information. [10 CFR 51.45(e)]

The NRC has identified and analyzed 78 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated these issues as Category 1, Category 2, or uncategorized. The NRC designated an issue as Category 1 if the following criteria were met:

- The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for offsite radiological impacts-collective impacts from other than the disposal of spent fuel and high-level waste).
- Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC concluded that one or more of the Category 1 criteria could not be met, the NRC designated the issue Category 2, which requires plant-specific analysis. The NRC designated one issue as uncategorized (chronic effects of electromagnetic fields), signifying that the categorization and impact definitions do not apply to this issue. Until such time that this uncategorized issue is categorized, applicants for license renewal are not required to submit information on this issue [10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 6]; therefore, this issue is not included in Tables 4.0-1, 4.0-2, or 4.0-3, nor is it addressed in Section 4.9. NRC rules do not require analyses of Category 1 issues that were resolved using generic findings [10 CFR 51, Subpart A, Appendix B, Table B-1] as described in the GEIS. Therefore, an applicant may reference the GEIS findings for Category 1 issues, absent new and significant information.

The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013a). In this guidance, new and significant information is defined as follows:

- Information that identifies a significant environmental issue not considered or addressed in the GEIS and, consequently, not codified in Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants, in Appendix B, Environmental Effect of Renewing the Operating License of a Nuclear Power Plant, to Subpart A, National Environmental Policy Act-Regulations Implementing Section 102(2), of 10 CFR 51; or
- Information not considered in the assessment of impacts evaluated in the GEIS, leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
- Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

4.0.1 Category 1 License Renewal Issues

> *The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(i)]*
>
> *[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal . . . .* (61 FR 28483)

Duke Energy has determined that, of the 60 Category 1 issues, six are not applicable to ONS because they result from design or operational features that do not exist at the facility. Table 4.0-1 lists these six issues and provides a brief explanation of why they are not applicable to the site. Table 4.0-2 lists the 54 issues which are applicable to the site. Duke Energy reviewed the NRC findings on these 54 issues and identified no new and significant information that would invalidate the findings for the site (Chapter 5). Therefore, Duke Energy adopts by reference the NRC findings for these Category 1 issues.

4.0.2 Category 2 License Renewal Issues

> *The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(ii)]*

> *The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues . . . . [10 CFR 1.53(c)(3)(iii)]*

The NRC designated 17 issues as Category 2. Duke Energy has determined that, of the 17 issues shown in Table 4.0-3, six issues are not applicable to ONS because they are applicable to plants with a different type of cooling system or to plants which have greater groundwater withdrawals.

For the 11 issues applicable to the site, the corresponding sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to renewal of the ONS Units 1, 2, and 3 ROLs and, when applicable, discuss potential mitigation alternatives to the extent appropriate. With the exception of threatened and endangered species/EFH, historic and cultural resources, and environmental justice, ONS has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE, consistent with the criteria that the NRC established in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

> **SMALL:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.
>
> **MODERATE:** Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> **LARGE:** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. For issues where probability is a key consideration (i.e., accident consequences), probability was a factor in determining significance.

Consistent with NRC guidance, ONS identified the significance of the impacts for the three Category 2 issues of threatened and endangered species/EFH, historic and cultural resources, and environmental justice as follows:

- For threatened and endangered species (ESA), the significance of the effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, (1) would have no effect on federally listed species; (2) are not likely to adversely affect federally listed species; (3) are likely to adversely affect federally listed species; or (4) are likely to jeopardize a federally listed species or adversely modify DCH. For EFH (Magnuson Stevens Fishery Conservation and Management Act), the significance of effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, would have: (1) no adverse impact; (2) minimal adverse impact; or (3) substantial adverse impact to the essential habitat of federally managed fish populations. (NRC 2013a)

- For historic and cultural resources (NHPA), the significance of the effects from license renewal can be characterized based on a determination that: (1) no historic properties are present (no effect); (2) historic properties are present but would not be adversely affected (no adverse effect); or (3) historic properties are adversely affected (adverse effect). (NRC 2013b)
- For environmental justice, impacts would be based on disproportionately high and adverse human health and environmental effects on minority and low-income populations. (NRC 2013b)

In accordance with NEPA practice, ONS considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are SMALL receive less mitigation consideration than impacts that are LARGE).

4.0.3 Uncategorized License Renewal Issues

The NRC determined that its categorization and impact-finding definitions did not apply to chronic effects of electromagnetic fields. Because the categorization and impact finding definitions do not apply as noted in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 5, applicants are not currently required to submit information on this issue.

4.0.4 Format of Issues Reviewed

The review and analysis of the Category 1 and 2 issues identified in NRC Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b) are presented in the following sections. The format for the review of these issues is described below. Although Chapter 5 describes the process by which Category 1 issues have been evaluated for new and significant information, specific issues are also being listed in this chapter for consistency purposes with the recommended NRC Regulatory Guide 4.2, Supplement 1 format.

- *Issue:* Title of the issue.
- *Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1:* The findings for the issue from 10 CFR 51, Subpart A, Appendix B, Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants.
- *Requirement:* Restatement of the applicable 10 CFR 51.53 requirement.
- *Background:* A background excerpt from the applicable section of the GEIS. The specific section of the GEIS is referenced for the convenience of the reader.

Analysis: An analysis of the environmental impact, taking into account information provided in the GEIS and 10 CFR 51, Subpart A, Appendix B, as well as current site-specific information. If an issue is not applicable, the analysis lists the explanation. The analysis section also provides a summary conclusion of the environmental impacts and identifies, as applicable, either ongoing or additional planned mitigation measures to reduce adverse impacts. For Category 1 issues listed in this chapter, an analysis is not required absent new and significant information.

Table 4.0-1 Category 1 Issues Not Applicable to ONS

Issue	Comment
Land Use	
Offsite land use in transmission line rights-of-way (ROWs)	All in-scope transmission lines subject to the evaluation of environmental impacts for license renewal are located completely within the ONS site.
Surface Water Resources	
Altered salinity gradients	ONS does not have cooling towers and does not discharge to an estuary.
Groundwater Resources	
Groundwater quality degradation (plants with cooling ponds in salt marshes)	ONS is located on a freshwater body and does not utilize cooling ponds.
Terrestrial Resources	
Cooling tower impacts on vegetation (plants with cooling towers)	ONS does not utilize cooling towers for condenser cooling purposes.
Aquatic Resources	
Impingement and entrainment of aquatic organisms (plants with cooling towers)	ONS does not utilize cooling towers for condenser cooling purposes.
Thermal impacts on aquatic organisms (plants with cooling towers)	ONS does not utilize cooling towers for condenser cooling purposes.

Table 4.0-2 Category 1 Issues Applicable to ONS (Sheet 1 of 3)

Resource	Issue
Land Use	Onsite land uses
	Offsite land uses
Visual Resources	Aesthetic impacts
Air Quality	Air quality impacts (all plants)
	Air quality effects of transmission lines
Noise	Noise impacts
Geologic Environment	Geology and soils
Surface Water Resources	Surface water use and quality (non-cooling system impacts)
	Altered current patterns at intake and discharge structures
	Altered thermal stratification of lakes
	Scouring caused by discharged cooling water
	Discharge of metals in cooling system effluent
	Discharge of biocides, sanitary wastes, and minor chemical spills
	Surface water use conflicts (plants with once-through cooling systems)
	Effects of dredging on surface water quality
	Temperature effects on sediment transport capacity
Groundwater Resources	Groundwater contamination and use (non-cooling system impacts)
	Groundwater use conflicts (plants that withdraw less than 100 gallons per minute)
	Groundwater quality degradation resulting from water withdrawals
Terrestrial Resources	Exposure of terrestrial organisms to radionuclides
	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)
	Bird collisions with plant structures and transmission lines
	Transmission line right-of-way management impacts on terrestrial resources
	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)

Table 4.0-2 Category 1 Issues Applicable to ONS (Sheet 2 of 3)

Resource	Issue
Aquatic Resources	Entrainment of phytoplankton and zooplankton (all plants)
	Infrequently reported thermal impacts (all plants)
	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication
	Effects of nonradiological contaminants on aquatic organisms
	Exposure of aquatic organisms to radionuclides
	Effects of dredging on aquatic organisms
	Effects on aquatic resources (non-cooling system impacts)
	Impacts of transmission line right-of-way management on aquatic resources
	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses
Socioeconomics	Employment and income, recreation and tourism
	Tax revenues
	Community services and education
	Population and housing
	Transportation
Human Health	Radiation exposures to the public
	Radiation exposures to plant workers
	Human health impact from chemicals
	Microbiological hazards to plant workers
	Physical occupational hazards
Postulated Accidents	Design-basis accidents
Waste Management	Low-level waste storage and disposal
	Onsite storage of spent nuclear fuel
	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal
	Mixed-waste storage and disposal
	Nonradioactive waste storage and disposal

Table 4.0-2 Category 1 Issues Applicable to ONS (Sheet 3 of 3)

Resource	Issue
Uranium Fuel Cycle	Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste
	Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste
	Nonradiological impacts of the uranium fuel cycle
	Transportation
Termination of Nuclear Power Plant Operations and Decommissioning	Termination of plant operations and decommissioning

Table 4.0-3 Category 2 Issues Applicability to ONS (Sheet 1 of 2)

Resource Issue	Applicability	ER Section
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)	Not Applicable	4.5.3
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	Not Applicable	4.5.2
Groundwater quality degradation (plants with cooling ponds at inland sites)	Not Applicable	4.5.4
Radionuclides released to groundwater	Applicable	4.5.5
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts)	Applicable	4.6.5
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.6.4
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.6.3
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat	Applicable	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	Applicable	4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) Note: 10 CFR 51, Subpart A, Appendix B, Table B-1 includes plants using lakes as plants where this Category 2 issue is applicable.	Applicable	4.9.1
Electric shock hazards	Applicable	4.9.2

Table 4.0-3 Category 2 Issues Applicability to ONS (Sheet 2 of 2)

Resource Issue	Applicability	ER Section
Environmental Justice		
Minority and low-income populations	Applicable	4.10.1
Cumulative Impacts		
Cumulative impacts	Applicable	4.12
Postulated Accidents		
Severe accidents	Applicable	4.15

4.1 Land Use and Visual Resources

4.1.1 Onsite Land Use

4.1.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Changes in onsite land use from continued operations and refurbishment associated with license renewal would be a small fraction of the nuclear power plant site and would involve only land that is controlled by the licensee.

4.1.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.1.1.3 Background [GEIS Section 4.2.1.1]

Operational activities at a nuclear power plant during the license renewal term would be similar to those occurring during the current license term. Generally, onsite land use conditions would remain unchanged. However, additional spent nuclear fuel and low-level radioactive waste generated during the license renewal term could require the construction of new or expansion of existing onsite storage facilities. Should additional storage facilities be required, this action would be addressed in separate license reviews conducted by the NRC. Refurbishment activities, such as steam generator and vessel head replacement, have not permanently changed onsite land use conditions.

4.1.1.4 Analysis

Onsite land use information is discussed in Section 3.2.1 of this ER. No license renewal-related refurbishment activities have been identified, as presented in Section 2.3. In addition, no license renewal-related construction activities have been identified. Therefore, no changes in onsite land use during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that onsite land use impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.2.1.1). Based on Duke Energy's review, no new and significant information was identified as it relates to onsite land use, and further analysis is not required.

4.1.2 Offsite Land Use

4.1.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Offsite land use would not be affected by continued operations and refurbishment associated with license renewal.

4.1.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.1.2.3 Background [GEIS Section 4.2.1.1]

The impacts of continued plant operations during the license renewal term and refurbishment on offsite land use have shown no power plant-related population changes or significant tax revenue changes due to license renewal. Non-outage employment levels at nuclear power plants have remained relatively unchanged or have decreased. With no increase in the number of workers, there has been no increase in housing, infrastructure, or demand for services beyond what has already occurred. Therefore, the NRC concluded in the 2013 GEIS that operational activities during the license renewal term would be similar to those occurring during the current license term and would not affect offsite land use beyond what has already been affected.

For plants that have the potential to impact a coastal zone or coastal watershed, as defined by each state participating in the national Coastal Zone Management Program (CZMP), applicants for license renewal must submit to the affected state a certification that the proposed license renewal is consistent with the state CZMP. Applicants must coordinate with the state agency that manages the state CZMP to obtain a determination that the proposed nuclear plant license renewal would be consistent with the state program.

4.1.2.4 Analysis

Offsite land use information is discussed in Section 3.2.2 of this ER. As presented in Section 2.5, there are no plans to add workers to support plant operations during the SLR operating term and, as presented in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, no changes in offsite land use during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that offsite land use impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.2.1.1). ONS, located in Oconee County, is not within the South Carolina coastal zone and CZMP does not apply (see Section 9.5.10). Based on Duke Energy's review, no new and significant information was identified as it relates to offsite land use, and further analysis is not required.

4.1.3 Aesthetics Impacts

4.1.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. No important changes to the visual appearance of plant structures or transmission lines are expected from continued operations and refurbishment associated with license renewal.

4.1.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.1.3.3 Background [GEIS Section 4.2.1.2]

License renewal environmental reviews conducted by the NRC have shown that nuclear power plants and transmission lines have not changed in appearance significantly over time, so aesthetic impacts are not anticipated. The NRC concluded that the impacts on visual resources would be SMALL for all plants, because the existing visual profiles of nuclear power plants were not expected to change during the license renewal term. The NRC's assessment of this issue included consideration of a limited number of situations where nuclear power plants had a negative effect on visual resources. Negative perceptions were based on aesthetic considerations (for instance, the plant is out of character or scale with the community or the viewshed), physical environmental concerns, safety and perceived risk issues, an anti-plant attitude, or an anti-nuclear orientation. It is believed that these negative perceptions would persist regardless of mitigation measures.

In addition, the visual appearance of transmission lines is not expected to change during the license renewal term. After the containment building and cooling towers, transmission line towers are probably the most frequently observed structure associated with nuclear power plants. Transmission lines from nuclear power plants are generally indistinguishable from those from other power plants. Because electrical transmission lines are common throughout the United States, they are generally perceived with less prejudice than the nuclear power plant itself. Also, the visual impact of transmission lines tends to wear off when viewed repeatedly.

4.1.3.4 Analysis

The visual appearance of the plant and in-scope transmission lines is discussed in Section 3.2.3 of this ER. As presented in Section 3.2.3, the ONS plant is in a rural area on the bank of Lake Keowee adjacent to the dam. Predominant visual features at ONS are the reactor containment buildings, the turbine buildings, and transmission lines.

The site structures located within the protected area of the plant are set back from the shoreline of Lake Keowee and surrounded by forest, offering limited offsite viewing opportunities. Because of the wooded setting and remote location, ONS would have minimal visual impact on neighboring properties. Because the reactor containment buildings are set back from the shoreline, they blend in with the dam structure. As noted in Section 2.3, no refurbishment or construction activities have been identified that would change the aesthetics of the ONS facility during the proposed SLR operating term. Therefore, no changes in visual resources during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that aesthetic impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.2.1.2). Based on Duke Energy's review, no new and

significant information was identified as it relates to visual resources, and further analysis is not required.

4.2 Air Quality

4.2.1 Air Quality Impacts (All Plants)

4.2.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Air quality impacts from continued operations and refurbishment associated with license renewal are expected to be small at all plants. Emissions resulting from refurbishment activities at locations in or near air quality non-attainment or maintenance areas would be short-lived and would cease after these refurbishment activities are completed. Operating experience has shown that the scale of refurbishment activities has not resulted in exceedance of the de minimis thresholds for criteria pollutants. BMPs, including fugitive dust controls and the imposition of permit conditions in state and local air emissions permits, would ensure conformance with applicable state or tribal implementation plans.

Emissions from emergency diesel generators and fire pumps, and routine operations of boilers used for space heating, would not be a concern, even for plants located in or adjacent to non-attainment areas. Impacts from cooling tower particulate emissions, even under the worst-case situations, have been SMALL.

4.2.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.2.1.3 Background [GEIS Section 4.3.1.1]

Impacts on air quality during normal plant operations can result from operations of fossil fuel-fired equipment needed for various plant functions. Each licensed plant typically employs emergency diesel generators for use as a backup power source. Emergency diesel generators and fire pumps typically require state or local operating permits. These diesel generators are typically tested once a month with several test burns of various durations (e.g., one to several hours). In addition to these maintenance tests, longer-running endurance tests are also typically conducted at each plant. Each generator is typically tested for 24 hours on a staggered test schedule (e.g., once every refueling outage).

In addition to the emergency diesel generators, fossil fuel (i.e., diesel-, oil-, or natural gas-fired) boilers are used primarily for evaporator heating, plant space heating, and/or feedwater purification. These units typically operate at a variable load on a continuous basis throughout the year unless end use is restricted to one application, such as space heating. The utility boilers at commercial plants are relatively small when compared with most industrial boilers and are typically regulated through state-level operating permits.

As presented in Section 3.3 of the GEIS, cooling tower drift can increase downwind PM concentrations, impair visibility, ice roadways, cause drift deposition, and damage vegetation and painted surfaces. Thus, although there is the potential for some air quality impacts to occur as a result of equipment and cooling tower operations, even in the worst-case situation (Hope Creek), the impacts have been SMALL, and licensees would be required to operate within state permit requirements.

In the 2013 GEIS, the NRC concluded that the impacts from plant refurbishment associated with license renewal on air quality are expected to be SMALL for most plants. Published findings from license renewal SEISs have shown that refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and months of time, as well as the degree of land disturbance that was conservatively estimated in the 1996 GEIS. Presumed air pollutant emissions, including levels of fugitive dust, have therefore not been realized.

4.2.1.4 Analysis

Air quality information is presented in Section 3.3.3 of this ER. No license renewal-related refurbishment activities have been identified, as presented in Section 2.3. As stated in the GEIS, BMPs, including fugitive dust controls and the imposition of permit conditions in SCDHEC air emissions permits, would ensure conformance with applicable state implementation plans.

As discussed in Section 3.3.3.1, Oconee County is in attainment with the NAAQS for all criteria air pollutants. As presented in Section 3.3.3.2, no future upgrade or replacement activities (e.g., diesel generators, diesel pumps) that would increase or decrease air emissions over the SLR operating term were identified as necessary for plant operations.

ONS is permitted under air permit No. CM-1820-0041. Duke Energy is not aware of any issues that will significantly change the permit compliance of ONS.

As discussed in Section 3.3.3.2, the ONS air permit contains conditions established by the SCDHEC to protect South Carolina's ambient air quality standards and ensure impacts are maintained at acceptable levels. Appropriate permit conditions would regulate any future ONS activities that may increase air pollutants or threaten the attainment status of Oconee County. Compliance with current and future air emissions regulatory requirements, applicable emissions control measures, and reporting requirements will ensure continued SMALL impact on ambient air quality.

In the GEIS, the NRC determined that air quality impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.3.1.1). Based on Duke Energy's review, no new and significant information was identified as it relates to air quality, and further analysis is not required].

4.2.2 Air Quality Effects of Transmission Lines

4.2.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

4.2.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.2.2.3 Background [GEIS Section 4.3.1.1]

Small amounts of ozone and substantially smaller amounts of oxides of nitrogen are produced by transmission lines during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface such as abrasions, dust particles, raindrops, and insects. Several studies have quantified the amount of ozone generated and concluded that the amount produced by even the largest lines in operation (765 kV) is insignificant.

Ozone concentrations generated by transmission lines are therefore too low to cause any significant effects. The minute amounts of oxides of nitrogen produced are similarly insignificant. A finding of SMALL significance for transmission lines, within this scope of review is supported by the evidence that production of ozone and oxides of nitrogen are insignificant and does not measurably contribute to ambient levels of those gases.

4.2.2.4 Analysis

Based on the license renewal GEIS, it was determined through several studies that the amount of ozone generated by even the largest lines in operation (765 kV) would be insignificant (NRC 2013a, Section 4.3.1.1). As discussed in Section 2.2.5, the in-scope transmission lines at ONS are 230 kV and 525 kV. Therefore, the production of ozone and oxides of nitrogen would be de minimis.

In the GEIS, the NRC determined that air quality effects of transmission lines from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.3.1.1). Based on Duke Energy's review, no new and significant information was identified as it relates to air quality effects of transmission lines, and further analysis is not required.

4.3 Noise

4.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Noise levels would remain below regulatory guidelines for offsite receptors during continued operations and refurbishment associated with license renewal.

4.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.3.3 Background [GEIS Section 4.3.1.2]

Major sources of noise at operating nuclear power plants are cooling towers, turbines, transformers, large pumps, and cooling water system motors. Nuclear plant operations have not changed appreciably with time, and no change in noise levels or noise-related impacts are expected during the license renewal term. Since no change is expected in the amount of noise generated during the license renewal term, the only issue of concern is the number of people now living close to the nuclear power plant who are exposed to operational noise.

Given the industrial nature of the power plant and the number of years of plant operation, noise from a nuclear plant is generally nothing more than a continuous minor nuisance. However, noise levels may sometimes exceed the 55 dBA level that the EPA uses as a threshold level to protect against excess noise during outdoor activities. However, according to the EPA, this threshold does "not constitute a standard, specification, or regulation," but was intended to provide a basis for state and local governments establishing noise standards. Nevertheless, noise levels at the site boundary are expected to remain well below regulatory standards for offsite residents.

Noise would also be generated by construction-related activities and equipment used during refurbishment. However, this noise would occur for relatively short periods of time (several weeks) and is not expected to be distinguishable from other operational noises at the site boundary nor create an adverse impact on nearby residents.

4.3.4 Analysis

Noise associated with plant operations is presented in Section 3.4. No license renewal-related refurbishment activities have been identified, as presented in Section 2.3. As discussed in Section 3.4, because ONS is located in a rural area (away from urban areas) and the nearest residence is located approximately 1.03 miles away, it is unlikely that noise from ONS would affect offsite residences.

As presented in Section 3.4, ONS has received no noise complaint for the period 2014–2018. ONS may make a public announcement via local media beforehand for planned noise-generating activities when necessary members of the public can contact the local media or plant with questions for an unplanned noise-generating activity. ONS also monitors noise at and around the plant site for occupational and ambient effects on an as-needed basis.

In the license renewal GEIS (NRC 2013a, Section 4.3.1.2), the NRC determined that noise impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants and designated this as a Category 1 issue. Based on Duke Energy's review, no

new and significant information was identified as it relates to noise, and further analysis is not required.

4.4 Geology and Soils

4.4.1 Findings From 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. The effect of geologic and soil conditions on plant operations and the impact of continued operations and refurbishment activities on geology and soils would be SMALL for all nuclear power plants and would not change appreciably during the proposed license renewal term.

4.4.2 Requirement [10 CFR 51.53(C)(3)(IV)]

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

4.4.3 Background [GEIS Section 4.4.1]

The impact of continued operations and refurbishment associated with subsequent license renewal on geologic and soil resources would consist of soil disturbance, including sediment and/or any associated bedrock, for projects, such as replacing or adding buildings, roads, parking lots, and belowground and aboveground utility structures. Implementing BMPs would reduce soil erosion and subsequent impacts on surface water quality. These practices include, but are not limited to, minimizing the amount of disturbed land; stockpiling topsoil before ground disturbance; mulching and seeding disturbed areas; covering loose materials with geotextiles; using silt fences to reduce sediment loading to surface water; using check dams to minimize the erosive power of drainages; and installing proper culvert outlets to direct flows in streams or drainages.

Detailed geotechnical analyses would be required to address the stability of excavations, foundation footings, and slope cuts for building construction, road creation, or other refurbishment-related construction projects. Depending on the plant location and design, riverbank or coastline protection might need to be upgraded, especially at water intake or discharge structures if natural flows, such as storm surges, cause an increase in erosion. In addition, the FPPA [7 USC 4201 et seq.] requires federal agencies to consider agency actions affecting the preservation of farmland, including prime and other important farmland soils, as described in Section 3.4 of the GEIS.

4.4.4 Analysis

Geology and soils information is presented in Section 3.5 of this ER. Routine infrastructure, renovation, and maintenance projects would be expected during continued operation. As discussed in Section 3.5.3.2 and Section 3.6.1.2.2, ONS maintains and implements a SWPPP that identifies potential sources of pollution that would reasonably be expected to affect the

quality of stormwater, such as erosion, and identifies BMPs used to prevent or reduce the pollutants in stormwater discharges. These practices, as they relate to erosion, include nonstructural preventive measures and source controls, as well as structural controls to prevent erosion or treat storm water containing pollutants caused by erosion. In addition, any ground disturbance of one or more acres requires a construction stormwater permit to be obtained from the SCDHEC. The construction storm water permit specifies BMPs to reduce erosion caused by storm water runoff, thereby minimizing the risk of pollution from soil erosion and sediment, and potentially from other pollutants that the storm water may contact. Although no license renewal-related refurbishment or construction activities are planned, any such activities would continue to be managed in adherence to the ONS SWPPP.

In the GEIS, the NRC determined that geology and soil impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013b, Section 4.4.1). Based on Duke Energy's review, no new and significant information was identified as it relates to geology and soils, and further analysis is not required.

4.5 Water Resources

4.5.1 Surface Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.5.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts could be of small or moderate significance, depending on makeup water requirements, water availability, and competing water demands.

4.5.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river . . . must be provided.

4.5.1.3 Background [GEIS Section 4.5.1.1]

Nuclear power plant cooling systems may compete with other users relying on surface water resources, including downstream municipal, agricultural, or industrial users. Closed-cycle cooling is not completely closed, because the system discharges blowdown water to a surface water body and withdraws water for makeup of both the consumptive water loss due to evaporation and drift (for cooling towers) and blowdown discharge. For plants using cooling towers, the makeup water needed to replenish the consumptive loss of water to evaporation can be significant and is reported at 60 percent or more of the condenser flow rate. Cooling ponds will also require makeup water as a result of naturally occurring evaporation, evaporation of the warm effluent, and possible seepage to groundwater.

Consumptive use by plants with cooling ponds or cooling towers using makeup water from a river during the license renewal term is not expected to change unless power uprates, with associated increases in water use, are proposed. Such uprates would require an environmental assessment by the NRC. Any river, regardless of size, can experience low flow conditions of varying severity during periods of drought and changing conditions in the affected watershed such as upstream diversions and use of river water and thus experience consumptive use impacts.

Population growth around nuclear power plants has increased demand on municipal water systems, including systems that rely on surface water. Municipal intakes located downstream from a nuclear power plant could experience water shortages, especially in times of drought. Similarly, water demands upstream from a plant could impact the water availability at the plant's intake.

Water use conflicts associated with plants with cooling ponds or cooling towers using makeup water from a river with low flow were considered to vary among sites because of differing site-specific factors, such as makeup water requirements, water availability (especially in terms of varying river flow rates), changing or anticipated changes in population distributions, or changes in agricultural or industrial demands.

4.5.1.4 Analysis

As discussed in Section 2.2.3 of this ER, ONS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable and further analysis is not required.

4.5.2 Groundwater Use Conflicts (Plants with Closed-Cycle Cooling Systems That Withdraw Makeup Water from a River)

4.5.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Water use conflicts could result from water withdrawals from rivers during low-flow conditions, which may affect aquifer recharge. The significance of impacts would depend on makeup water requirements, water availability, and competing water demands.

4.5.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands . . . must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

4.5.2.3 Background [GEIS Section 4.5.1.2]

In the case of plants with cooling towers or cooling ponds that rely on a river for makeup of consumed (evaporated) cooling water, it is possible water withdrawals from the river could lead to groundwater use conflicts with other users. This situation could occur because of the interaction between groundwater and surface water, especially in the setting of an alluvial aquifer in a river valley. Consumptive use of the river water, if significant enough to lower the river's water level, would also influence water levels in the alluvial aquifer. Shallow wells of nearby groundwater users could therefore have reduced water availability or go dry. During times of drought, the effect would occur naturally, although withdrawals for makeup water would increase the effect.

4.5.2.4 Analysis

As discussed in Section 2.2.3 of this ER, ONS utilizes a once-through cooling system and does not utilize a closed-cycle cooling system for condenser cooling purposes. Therefore, this issue is not applicable and further analysis is not required.

4.5.3 Groundwater Use Conflicts (Plants That Withdraw More Than 100 GPM)

4.5.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.

4.5.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(C)]

If the applicant's plant pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater must be provided.

4.5.3.3 Background [GEIS Section 4.5.1.2]

A nuclear plant may have several wells with combined pumping in excess of 100 gpm (378 liters per minute). Overall site pumping rates of this magnitude have the potential to create conflicts with other local groundwater users if the cone of depression extends to the offsite well(s). Large offsite pumping rates for municipal, industrial, or agricultural purposes may, in turn, lower the water level at power plant wells. For any user, allocation is normally determined through a state-issued permit.

Groundwater use conflicts have not been observed at any nuclear power plants, and no significant change in water well systems is expected over the license renewal term. If a conflict did occur, it might be possible to resolve it if the power plant relocated its well or wellfield to a different part of the property. The siting of new wells would be determined through a hydrogeologic assessment.

4.5.3.4 Analysis

As discussed in Section 3.6.3.2, the ONS property has three (3) groundwater drawdown wells for the standby shutdown facility and one groundwater recovery well for extraction of tritium

impacted groundwater. There are several potable groundwater supply wells installed on the ONS property originally intended for irrigation use; none have been used within the last 10 years and they have all been abandoned or are being assessed for abandonment.

The three groundwater drawdown wells at the standby shutdown facility (DMW-1, DMW-2, and DMW-3) withdraw a total approximate average of 20 gpm of groundwater (Section 3.6.3.2). Recovery well RW-1 has an installed pumping capacity of approximately 11.75 gpm and withdrew an average of 9.04 gpm between 2011 (beginning of extraction) and 2016 (Pentair 2014). Recording of RW-1 withdrawal quantities was terminated in 2016. Therefore, total groundwater withdrawals for ONS are approximately 29.04 gpm (2011 to 2016).

As it is not anticipated that groundwater withdrawal increases above the reported quantities will be required during the proposed SLR operating term; therefore, this issue is not applicable and further analysis is not required.

4.5.4 Groundwater Quality Degradation (Plants with Cooling Ponds at Inland Sites)

4.5.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Inland sites with closed-cycle cooling ponds could degrade groundwater quality. The significance of the impact would depend on cooling pond water quality, site hydrogeologic conditions (including the interaction of surface water and groundwater), and the location, depth, and pump rate of water wells.

4.5.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(D)]

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

4.5.4.3 Background [GEIS Section 4.5.1.2]

Some nuclear power plants that rely on unlined cooling ponds are located at inland sites surrounded by farmland or forest or undeveloped open land. Degraded groundwater has the potential to flow radially from the ponds and reach offsite groundwater wells. The degree to which this occurs depends on the water quality of the cooling pond; site hydrogeologic conditions (including the interaction of surface water and groundwater); and the location, depth, and pump rate of water wells. Mitigation of significant problems stemming from this issue could include lining existing ponds, constructing new lined ponds, or installing subsurface flow barrier walls. Groundwater monitoring networks would be necessary to detect and evaluate groundwater quality degradation. The degradation of groundwater quality associated with cooling ponds has not been reported for any inland nuclear plant sites.

4.5.4.4 Analysis

As discussed in Section 2.2.3 of this ER, ONS utilizes a once-through cooling system and does not utilize cooling ponds. Therefore, this issue is not applicable and further analysis is not required.

4.5.5 Radionuclides Released to Groundwater

4.5.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Leaks of radioactive liquids from plant components and pipes have occurred at numerous plants. Groundwater protection programs have been established at all operating nuclear power plants to minimize the potential impact from any inadvertent releases. The magnitude of impacts would depend on site-specific characteristics.

4.5.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(P)]

An applicant shall assess the impact of any documented inadvertent releases of radionuclides into groundwater. The applicant shall include in its assessment a description of any groundwater protection program used for the surveillance of piping and components containing radioactive liquids for which a pathway to groundwater may exist. The assessment must also include a description of any past inadvertent releases and the projected impact to the environment (e.g., aquifers, rivers, lakes, ponds, ocean) during the license renewal term.

4.5.5.3 Background [GEIS Section 4.5.1.2]

The issue is relevant to license renewal because all commercial nuclear power plants routinely release radioactive gaseous and liquid materials into the environment. These radioactive releases are designed to be planned, monitored, documented, and released into the environment at designated discharge points. But over the years, there have been numerous events at nuclear power reactor sites which involved unknown, uncontrolled, and unmonitored releases of liquids containing radioactive material into the groundwater.

The majority of the inadvertent liquid release events involved tritium, which is a radioactive isotope of hydrogen. However, other radioactive isotopes, such as cesium and strontium, have also been inadvertently released into the groundwater. The types of events include leakage from spent fuel pools, buried piping, and failed pressure relief valves on an effluent discharge line.

In 2006, the NRC's executive director for operations chartered a task force to conduct a lessons learned review of these incidents. On September 1, 2006, the task force issued its report, *Liquid Radioactive Release Lessons Learned Task Force Report*.

The most significant conclusion dealt with the potential health impacts on the public from the inadvertent releases. Although there were numerous events during which radioactive liquid was released to the groundwater in an unplanned, uncontrolled, and unmonitored fashion, based on

the data available, the task force did not identify any instances where public health and safety were adversely impacted.

On the basis of the information and experience with these leaks, the NRC concludes that the impact to groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, the radionuclides involved, hydrogeologic factors, the distance to receptors, and the response time of plant personnel in identifying and stopping the leak in a timely fashion.

4.5.5.4 Analysis

A description of the ONS groundwater protection program is presented in Section 3.6.2.4. Table 3.6-3 presents well construction details for the ONS groundwater monitoring wells, while Figure 3.6-7 shows the location of the wells. As discussed in Section 3.6.3.2, two state-registered water wells are located within a 2-mile band around the ONS property boundary.

As presented in Section 3.6.4.2.1, no unplanned liquid radioactive releases have occurred at ONS between 2014 and 2018.

As discussed in Section 3.6.3.2, tritium levels have been detected well below the EPA's maximum contaminant limit of 20,000 pCi/L.

Therefore, since water from station uses continues to be processed and monitored in compliance with licensing and permitting, Duke Energy concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond accordance with Duke Energy's existing groundwater protection program.

4.6 Ecological Resources

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

4.6.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, OR LARGE. The impacts of impingement and entrainment are SMALL at many plants but may be MODERATE or even LARGE at a few plants with once-through cooling systems and cooling ponds, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.

4.6.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of the current CWA 316(b) determinations or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from impingement and entrainment.

4.6.1.3 Background [GEIS Section 4.6.1.2]

Impingement occurs when organisms are held against the intake screen or netting placed within intake canals. Most impingement involves fish and shellfish. At some nuclear plants, other vertebrate species may also be impinged on the traveling screens or on intake netting placed within intake canals.

Entrainment occurs when organisms pass through the intake screens and travel through the condenser cooling system. Aquatic organisms typically entrained include ichthyoplankton (fish eggs and larvae), larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. Juveniles and adults of some species may also be entrained if they are small enough to pass through the intake screen openings, which are commonly 0.38 inches (1 cm) at the widest point.

The magnitude of the impact would depend on plant-specific characteristics of the cooling system (including location, intake velocities, screening technologies, and withdrawal rates) and characteristics of the aquatic resource (including population distribution, status, management objectives, and life history).

4.6.1.4 Analysis

The three nuclear power generating units at ONS use a once-through cooling water system with cooling water for all units withdrawn from Lake Keowee. Each of the units has four CCW pumps and each pump has two screens. The screens are fixed and are 10.75 feet with 3/8-inch square mesh. Screens are removed and backwashed with lake water and fire hoses when they require cleaning. Debris from the screens is collected and disposed of at a permitted landfill. The CCW intake system consists of a skimmer wall and 1.5-km intake canal. The skimmer wall extends from 244.45 mmsl to 223.38 mmsl. The main CCW pumps withdraw water at a maximum capacity of 3,059 MGD from the intake canal through the main condenser. The cooling water system at ONS is operated under NPDES permit No. SC0000515.

Duke Energy commissioned a one-year impingement study from September 2006 through August 2007 to calculate a baseline of impinged organisms. For the 12-month period, an estimated 43,923 fish and 109 kg of fish biomass were impinged based on 1,162 impinged fish and 2,873 g of fish biomass collected during the sampling events. A total of 12 fish and invertebrate species were collected during the impingement study: threadfin shad, blueback herring, bluegill, spotted bass, redbreast sunfish, redeye bass, warmouth, golden shiner, flathead catfish, white catfish, blackbanded darter, and Asiatic clam. Threadfin shad and blueback herring were the two most commonly impinged species, which is similar to impingement monitoring data from 1990. Threadfin shad accounted for 73.1 percent of fish collected, and blueback herring comprised 21.5 percent. However, the removal of these two species by impingement at ONS amounts to 0.2 to 0.7 percent of the population each year. Threadfin shad and blueback herring are pelagic species that inhabit the open water of Lake Keowee. Because ONS uses a skimmer wall and pulls water from the deepest part of the lake, pelagic species are more susceptible to impingement. Threadfin shad and blueback herring

have high reproductive rates, rapid growth rates, and short life spans, compensating for any losses experienced by the populations. The populations of both species have remained stable between 1997 and 2013, suggesting that continued operation of ONS will have little to no impact on the sustainability of these populations (FERC 2016a, Section 3.3.2.2).

Periodic impingement studies have been conducted between 1975 and 2007. The most recent study, conducted between 2006 and 2007, determined that intake inflows were highest during the months of June through September, but densities of impinged fish were lowest during these months, particularly June through August. Impingement rates were highest between September and November. This is slightly different than results from the 1975–1976 study that indicated impingement rates were greatest from January through March, when intake flows are typically lower. However, the results from both studies suggest that because the timing of the highest inflows and greatest impingement rates are at different periods, the impact of intake on aquatic organisms is likely to be minimal. Duke Energy determined that intake velocities in front of the generation intakes were less than one feet per second (fps) with one unit generating and only slightly greater than one fps with two units generating. These intake velocities remain below the burst swim speed of blueback herring (1.5-8.2 fps) and threadfin shad (1.56-6.56 fps) (FERC 2016a, Section 3.3.2.2). Although the studies were conducted with two units generating at one time, results would likely be similar with intake rates still below the burst swim speed of commonly impinged species while all three units are generating. Additionally, the loss of fish from daily impingement is equivalent to the daily harvest of a single fisherman, therefore, there are no long-term changes in abundance expected for the commonly impinged species.

An analysis was conducted to determine the potential benefits/disadvantages of installing new entrainment reduction technologies which included the installation of mechanical draft cooling towers or the installation and operation of fine-mesh screens with an aquatic organism return system. The model-based estimates were based on conservative assumptions (e.g., all entrained organisms were considered to affect recreational fisheries either directly as equivalent adults or indirectly through trophic transfer of production foregone biomass) and include evaluations of uncertainty at multiple stages of the development process. The social cost to social benefit comparison yielded substantial net-negative benefits for the modeled entrainment reduction technologies, and unavoidable adverse effects were identified for both technologies evaluated. Monetized social costs and social benefits were estimated for both technologies to provide a common basis for comparison.

The study demonstrated that the additional entrainment reduction technologies that were identified as feasible are not justified as best technology available for entrainment at Oconee as they would result in adverse effects (e.g., increased air emissions, impacts to system reliability) and the estimated social costs would be wholly disproportionate compared to the potential social benefits. No federal or state threatened or endangered fish or shellfish and no freshwater mussels were collected in the historical impingement and entrainment study and none were collected during the 2016–2017 study. Additionally, the diverse and balanced aquatic community in Lake Keowee has remained consistent since 2006. Therefore, the current

impingement and entrainment technologies represent the best technology available to protect the aquatic community of Lake Keowee at ONS.

Entrainment was studied between 2016 and 2017. The period of entrainment during this time was relatively low, with peaks occurring in June and July. The peaks correspond to the spawning period of blueback herring, which is the species with the highest rates of entrainment. However, blueback herring are prolific spawners with both high fecundity and high natural mortality rates. Threadfin shad also made up a significant portion of the entrained species, but is similar in fecundity and mortality rates to blueback herring. Therefore, entrainment is unlikely to have adverse impacts on this species or threadfin shad.

Lake Keowee fishery resources have been monitored by various sources (USFWS, SCDNR, and Duke Energy) since 1972. Fish populations have remained stable and similar to studies conducted since 1993, indicating that continued operation of ONS will have little to no long-term impact on fish populations in Lake Keowee.

Duke Energy complies with the current NPDES permit and will comply with future renewal of the permit, implementing best available technology requirements to minimize impacts of impingement and entrainment. Because of continued compliance with NPDES requirements, Duke Energy concludes that impacts from impingement and entrainment of aquatic organisms during the proposed SLR operating term would be SMALL. Although additional mitigation measures may be implemented in the future as a result of the 316(b) rule, these measures would minimize the already existing SMALL impacts.

4.6.2 Thermal Impacts on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, OR LARGE. Most of the effects associated with thermal discharges are localized and are not expected to affect overall stability of populations or resources. The magnitude of impacts would depend on site-specific thermal plume characteristics and the nature of aquatic resources in the area.

4.6.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems the application shall provide a copy of a 316(a) variance in accordance with 40 CFR Part 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from thermal changes.

4.6.2.3 Background [GEIS Section 4.6.1.2]

Because characteristics of both the thermal discharges and the affected aquatic resources are specific to each site, the NRC classified heat shock as a Category 2 issue that required a site-specific assessment for license renewal. The NRC found the potential for thermal discharge

impacts to be greatest at plants with once-through cooling systems, primarily because of the higher discharge temperatures and larger thermal plume area compared to plants with cooling towers.

The impact level at any plant depends on the characteristics of its cooling system (including location and type of discharge structure, discharge velocity and volume, and three-dimensional characteristics of the thermal plume) and characteristics of the affected aquatic resources (including species present and their physiology, habitat, population distribution, status, management objectives, and life history).

4.6.2.4 Analysis

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary and, using a variance, obtain alternative facility-specific thermal discharge limits [33 USC 1326].

As discussed in Section 2.2.3, ONS has a once-through heat dissipation system. Each generating unit has three separate water loops used as part of its heated water discharge. The primary coolant loop is a closed piping system: pressurized water in the system is circulated through the reactor and transfers heat from the reactor to the steam generator. The secondary loop is also a closed system: water from this system is converted into steam (in the steam generators) that is used to drive the turbine. The third loop is an open system: water from the Little River arm of Lake Keowee is used to cool the spent steam in the secondary loop, and then it is returned to the Keowee River arm of Lake Keowee (NRC 1999b, Section 2.1.3). The average flow from the condenser cooling unit was 2,533 MGD and maximum daily value was 3,059 MGD.

Duke Energy has requested an extension of the 316(a) thermal variance with its NPDES permit renewal request submitted March 28, 2013. The thermal variance is administratively extended until SCDHEC acts upon the NPDES renewal.

The NPDES permit establishes both a maximum allowable discharge temperature, and a limit for increases of water temperature between the intake and discharge. The maximum discharge temperatures "shall not exceed 100°F as a daily average, unless critical hydrological, meteorological, and electrical demand conditions apply. In such situations, the discharge temperature shall not be allowed to exceed 103°F". Duke Energy has monitored water temperatures below Keowee Dam since 2000, and the temperatures have demonstrated a stable pattern with temperatures never exceeding South Carolina's 90°F temperature standard (FERC 2016a, Section 3.3.2.1). Monitoring conducted between 2006 and 2011 demonstrated that the Little River surface temperatures varied little throughout the length of the basin, with temperatures at locations 501 (approximately 4 miles south of ONS in the Little River basin) and 500 (approximately 5 miles south of ONS in the Little River basin) nearly identical and only slightly higher at location 502 (approximately one mile south of the ONS intake). Relatively little spatial variability within the Little River watershed indicates a lack of considerable migration of the ONS thermal plume into the Little River watershed. Surface temperatures 200 meters from

Keowee Dam ranged from 14.2°C to 34.3°C. Surface temperatures associated with the thermal discharge from ONS for the 2006–2011 period were similar in magnitude and spatial distribution to those observed in previous investigations.

The phytoplankton population in Lake Keowee was monitored four times a year from 2006 through 2011. Lake Keowee was found to support a small, but highly diverse and viable phytoplankton community during this period. Results indicated that there was no shift towards a dominance of thermally tolerant species, indicating that the thermal plume has had minimal impact on the phytoplankton community. Additionally, there have been no algae blooms in Lake Keowee during this time. Similarly, studies conducted during the same time period concluded that Lake Keowee was found to support a highly diverse and viable zooplankton community. The results from the 2006–2011 study show that species composition and population abundance was similar to studies conducted in the 1970s and from 1989–2005. There have been no shifts toward the dominance of thermally tolerant species, which indicates that the thermal plume has had minimal impacts on the zooplankton community in Lake Keowee.

The impacts of the thermal plume were studied again from 2012–2019. Results from the monitoring during this time period indicate that the water quality and chemistry continued to provide a suitable aquatic habitat for a diverse biological community. Both phytoplankton and zooplankton populations remained diverse with no short or long-term impacts from ONS operation. Finally, fish species abundance and diversity did not differ between the thermal plume zone and other areas of the lake, indicating that thermal impacts remain minimal to the fish community of Lake Keowee.

In conclusion, the thermal discharge associated with ONS outflow has been demonstrated to be protective of the Lake Keowee fishery. ONS is operating in conformance with its NPDES permit, and therefore is in compliance with CWA requirements. Because there are no planned operational changes during the proposed SLR operating term that would increase the temperature of ONS's existing thermal discharge, impacts are anticipated to be SMALL and mitigation measures are not warranted.

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

4.6.3.1 Findings from CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on aquatic resources in stream communities affected by water use conflicts could be of moderate significance in some situations.

4.6.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on stream (aquatic) ecological communities must be provided.

4.6.3.3 Background [GEIS Section 4.6.1.2]

Increased temperatures and/or decreased rainfall would result in lower river flows, increased cooling pond evaporation, and lowered water levels in the lakes or reservoirs. Regardless of overall climate change, droughts could cause problems with water supplies and allocations. Because future agricultural, municipal, and industrial users would continue to share their demands for surface water with power plants, conflicts might arise if the availability of this resource decreased.

Water use conflicts with aquatic resources could occur when water to support these resources is diminished either because of decreased water availability due to droughts; increased demand for agricultural, municipal, or industrial usage; or due to a combination of such factors. Water use conflicts with biological resources in stream communities are a concern due to the duration of license renewal and potentially increasing demands on surface water.

4.6.3.4 Analysis

As discussed in Section 2.2.3, ONS Units 1, 2, and 3 utilize a once-through cooling system and do not use cooling towers or cooling ponds for condenser cooling purposes. Therefore, this issue is not applicable and further analysis is not required.

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

4.6.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of MODERATE significance.

4.6.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on riparian (terrestrial) ecological communities must be provided.

4.6.4.3 Background [GEIS Section 4.6.1.1]

Water use conflicts with terrestrial resources in riparian communities could occur when water that supports these resources is diminished either because of decreased availability due to droughts; increased water demand for agricultural, municipal, or industrial usage; or a combination of such factors. For future license renewals, the potential range of impact levels at plants with cooling ponds or cooling towers using makeup water from a river cannot be determined at this time.

4.6.4.4 Analysis

As discussed in Section 2.3, ONS Units 1, 2, and 3 utilize a once-through cooling system and do not utilize cooling towers for condenser cooling purposes. Therefore, this issue is not applicable and further analysis is not required.

4.6.5 Effects on Terrestrial Resources (Non-Cooling System Impacts)

4.6.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, OR LARGE. Impacts resulting from continued operations and refurbishment associated with license renewal may affect terrestrial communities. Application of BMPs would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.

4.6.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats.

4.6.5.3 Background [GEIS Section 4.6.1.1]

Continued operations and refurbishment activities could continue to affect onsite terrestrial resources during the license renewal term at all operating nuclear power plants. Factors that could potentially result in impacts include landscape maintenance activities, stormwater management, and elevated noise levels. These impacts would, for the most part, be similar to past and ongoing impacts.

The characteristics of terrestrial habitats and wildlife communities currently on nuclear power plant sites generally developed in response to many years of typical operations and maintenance programs. While some may have reached a relatively stable condition, habitats and populations of some species may have continued to change gradually over time. Operations and maintenance activities during the license renewal term are expected to be similar to current activities. Because the species and habitats present on the sites (i.e., weedy species and habitats they make up) are generally tolerant of disturbance, it is expected that continued operations during the license renewal term would maintain these habitats and wildlife communities in their current state, or maintain current trends of change.

Terrestrial habitats and wildlife could be affected by ground disturbance from refurbishment-related construction activities. Land disturbed during the construction of new ISFSIs would range from about 2.5–10 acres. Other activities may include new parking areas for plant employees, access roads, buildings, and facilities. Temporary project support areas for equipment storage, worker parking, and material laydown areas could also result in the disturbance of habitat and wildlife.

Successful application of environmental review procedures employed by the licensees at many of the operating nuclear plant sites would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs to minimize the area affected; to control fugitive dust, runoff, and erosion from project sites; to reduce the spread of invasive nonnative plant species; and to reduce disturbance of wildlife in adjacent habitats could greatly reduce the impacts of continued operations and refurbishment activities.

4.6.5.4 Analysis

4.6.5.4.1 Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to important plant and animal habitats, and no further analysis is required.

4.6.5.4.2 Operational Activities

Terrestrial resources are described in Section 3.7.2. No license renewal-related construction activities or changes in operational practices have been identified that would involve disturbing habitats. Duke Energy would continue to conduct ongoing plant operation and maintenance activities during the proposed SLR term. Operational and maintenance activities that Duke Energy might undertake (e.g., roadways, piping installations, fencing, and other security infrastructure), would likely be confined to previously disturbed areas on the site. Existing regulatory programs that the site is subject to, as discussed in Sections 3.7.6 and 9.5, ensure that habitats and wildlife are protected. These are related to stormwater management for controlling the runoff of pollution sources such as sediment, metals, or chemicals, and spill prevention to ensure that BMPs and structural controls are in place to minimize the potential for a chemical release into the environment. As discussed in Section 3.7.5, Duke Energy has invasive species control guidance that includes requirements for the selection of appropriate and approved herbicides and pesticides.

In summary, adequate management programs and regulatory controls are in place to ensure that important plant and animal habitats are protected during the proposed SLR term. Therefore, Duke Energy concludes the impacts to terrestrial ecosystems from license renewal are SMALL and no additional mitigation measures beyond current management programs and existing regulatory controls are required.

4.6.6 Threatened, Endangered, and Protected Species, and Essential Fish Habitat

4.6.6.1 Findings from 10 CFR, Subpart A, Appendix B, Table B-1

The magnitude of impacts on threatened, endangered, and protected species, critical habitat, and EFH would depend on the occurrence of listed species and habitats and the effects of power plant systems on them. Consultation with appropriate agencies would be needed to determine whether special status species or habitats are present and whether they would be adversely affected by continued operations and refurbishment associated with license renewal.

4.6.6.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with federal laws protecting wildlife, including but not limited to, the ESA and EFH in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.

4.6.6.3 Background [GEIS Section 4.6.1.3]

There are several federal acts that provide protection to certain species and habitats that are treated here under a single issue. The issue includes impacts to biological resources such as threatened and endangered species and their critical habitat under the ESA, EFH as protected under the Magnuson-Stevens Fishery Conservation and Management Act, and impacts to mammalian species protected under the Marine Mammal Protection Act.

Factors that could potentially result in impacts on listed terrestrial species include habitat disturbance, cooling tower drift, operation and maintenance of cooling systems, transmission line ROW maintenance, collisions with cooling towers and transmission lines, and exposure to radionuclides. The listed species on or in the vicinity of nuclear power plants also range widely, depending on numerous factors such as the plant location and habitat types present.

Potential impacts of continued operations and refurbishment activities on federally or state-listed threatened and endangered species, protected marine mammals, and EFH could occur during the license renewal term. Factors that could potentially result in impacts to these species and habitats include impacts of refurbishment, other ground-disturbing activities, release of contaminants, effects of cooling water discharge on dissolved oxygen, gas supersaturation, eutrophication, thermal discharges, entrainment, impingement, reduction in water levels due to the cooling system operations, dredging, radionuclides, and transmission line maintenance.

4.6.6.4 Analysis

4.6.6.4.1 Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to threatened, endangered, and protected species, or EFH, and no further analysis is required.

4.6.6.4.2 Operational Activities

Impacts on Protected Species

As discussed in Section 3.7.8.1, there are nine federally listed threatened or endangered species that potentially occur within a 6-mile radius of ONS and there are seven state-listed species that occur in Pickens and Oconee counties. No critical habitat for these species exists within a 6-mile radius of ONS.

Of the nine federally listed species, habitat for six species does not occur on ONS: mountain sweet pitcherplant, dwarf-flowered heartleaf, persistent trillium, small whorled pogonia, smooth coneflower, and black-spored quillwort. Occurrences of these species at the ONS site are unlikely and would be incidental.

Habitat for two federally listed species, the northern long-eared bat and the bog turtle, does occur on or immediately adjacent to the ONS site. The bog turtle is also listed as threatened by the State of South Carolina.

The bald eagle is known to nest nearby on Lake Jocassee and Lake Hartwell. Suitable large trees for nesting and a large waterbody that provides a good source of food exist on the ONS site and nearby at Lake Keowee. Activities on the ONS site are evaluated to ensure compliance under the BGEPA and MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. ONS maintains a migratory bird SPUT authorized by the USFWS, which authorizes utilities to collect, transport, and temporarily possess migratory birds found dead on utility property, structures, and ROWs for avian mortality monitoring or disposal purposes (USFWS 2018a). Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by Duke Energy for the licensed life of the ONS facility. Adherence to these controls, as well as compliance with applicable laws and regulations, will minimize impacts to bald eagles. The continued operation of ONS is not likely to affect this species.

Suitable habitat for the northern long-eared bat exists on the ONS site, however, acoustic surveys conducted in 2015 found no evidence that the northern long-eared bat uses the site (FERC 2016a). Duke Energy conducts acoustic monitoring for threatened and endangered bat species prior to any construction or timber removal on site. If the northern long-eared bat was detected, Duke Energy's policies would ensure that construction or timber removal would be conducted so that the bat and its habitat are protected and any potential adverse impacts minimized (Section 3.7.7.3). Continued operation of ONS facilities are not likely to affect this species.

Although suitable habitat for the bog turtle exists near the ONS site, no sightings of bog turtles have been documented on the site or in the nearby vicinity (FERC 2016a). Duke Energy has administrative policies that protects wetland habitat and wetland dependent wildlife species (Section 9.5). Monitoring and adherence to the policies will protect habitat and minimize impacts to the bog turtle. Continued operation of ONS is not likely to affect this species.

Habitat for six state-listed species is located on the ONS or the species are highly mobile and may occur on the site, thus warranting further discussion. These species are Rafinesque's big-eared bat, eastern small-footed bats, Indiana bat, American peregrine falcon, Bewick's wren, and southern coal skink.

Migratory movements or local flight patterns may result in the occurrence of the American peregrine falcon and Bewick's wren on the ONS site. Suitable habitat for these species may be

located on portions of the ONS site not used for operations or in the vicinity of the site. Activities on the ONS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Duke Energy maintains policies and procedures for addressing every avian incident associated with ONS facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by Duke Energy for the licensed life of the ONS facility. Adherence to these controls, as well as compliance with applicable laws and regulations, will minimize impacts to any special status and protected species. The continued operation of ONS facilities is not likely to affect these species.

Local flight patterns and available roosting habitat could result in the occurrence of Rafinesque's big-eared bats, Indiana bats, and eastern small-footed bats on the ONS site. Acoustic surveys were conducted to identify bat species found within the vicinity of the site. Surveys identified Rafinesque's big eared bats and eastern small-footed bats in the vicinity of the site, but did not detect any Indiana bats. Suitable roosting habitat exists on the ONS site. However, continued operations of the ONS are not likely to impact bat species using roosting habitat within areas not utilized for operations. Duke Energy's compliance with federal, state, and local laws and regulations will minimize impacts to these species. These species are not likely to be affected by the continued operations of ONS.

Suitable habitat for the southern coal skink may exist on the ONS site or in the vicinity of the site; however, no individuals were identified during biological surveys (FERC 2016a). Duke Energy's compliance with federal, state, and local laws and regulations will minimize impacts to this species. This species is not likely to be affected by the continued operations of ONS.

Duke Energy is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support license renewal would be limited to previously disturbed areas onsite, and no additional land disturbance has been identified for the purpose of SLR. In addition, there are no plans to alter plant operations during the proposed SLR term which would affect threatened, endangered, and protected species.

As discussed in Section 3.7.6, Duke Energy has administrative controls in place at ONS to ensure the operational changes or construction activities are reviewed, and the impacts minimized, through implementation of BMPs. In addition, regulatory programs that the site is subject to, such as those discussed in Chapter 9, further serve to minimize impacts to any threatened, endangered, and protected species.

Impacts on EFH

As discussed in Section 3.7.8.5, no EFH exists at Lake Keowee and no HAPCs or EFH areas protected from fishing are located on or adjacent to ONS. Given Duke Energy's adherence to permit conditions and regulatory requirements and commitment to comply with future permit conditions and regulatory requirements, continued operation of ONS is not likely to adversely impact EFH, HAPCs, or EFH areas protected from fishing.

Migratory Bird Treaty Act

In addition to the bald eagle and peregrine falcon, several bird species that may visit the site are protected under the MBTA. As discussed in Section 9.5.6, ONS maintains a migratory bird special purpose utility permit authorized by the USFWS (Table 9.1-1), which authorizes Duke Energy to collect, transport, and temporarily possess migratory birds found dead on utility property, structures, and ROWs for avian mortality monitoring or disposal purposes (USFWS 2018a). Other bird species that occur within the 6-mile radius protected under the MBTA that are also considered species of conservation concern include: blue-winged warbler, Bachman's sparrow, eastern whip-poor-will, Kentucky warbler, king rail, prairie warbler, prothonotary warbler, red-headed woodpecker, and wood thrush (USFWS 2019d). When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. As discussed in Section 3.7.6, Duke Energy has administrative controls in place at ONS to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs. In addition, regulatory programs that the site is subject to, such as those discussed in Chapter 9, further serve to minimize the impacts to protected species. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to MBTA protected species. The continued operation of ONS is not likely to affect these MBTA protected species.

In summary, no license renewal-related refurbishment activities have been identified. As discussed above, the continued operation of the site would have no adverse effects to any federally or state-listed species, designated critical habitat, or EFH. Therefore, Duke Energy concludes that the proposed SLR would have no effect on threatened, endangered, and protected species in the vicinity of ONS, and mitigation measures beyond Duke Energy's current management programs and existing regulatory controls are not warranted.

4.7 Historic and Cultural Resources

4.7.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Continued operations associated with license renewal are expected to have no license renewal-related impacts as no refurbishment or construction activities have been identified; administrative procedure ensures protection of historic properties in the event of excavation activities. The NHPA requires the federal agency to consult with the state historic preservation officer (SHPO) and appropriate Native American tribes to determine the potential effects on historic properties and mitigation, if necessary.

4.7.2 Requirement [10 CFR 51.53(c)(3)(ii)(K)]

All applicants shall identify any potentially affected historic or archaeological properties and assess whether any of these properties will be affected by future plant operations and any planned refurbishment activities in accordance with the NHPA.

4.7.3 Background [GEIS Section 4.7.1]

The NRC will identify historic and cultural resources within a defined APE. The license renewal APE is the area that may be impacted by ground-disturbing or other operational activities associated with continued plant operations and maintenance during the license renewal term and/or refurbishment. The APE typically encompasses the nuclear power plant site, its immediate environs, including viewshed, and the transmission lines within this scope of review. The APE may extend beyond the nuclear plant site and transmission lines when these activities may affect historic and cultural resources.

Continued operations during the license renewal term and refurbishment activities at a nuclear power plant can affect historic and cultural resources through (1) ground-disturbing activities associated with plant operations and ongoing maintenance (e.g., construction of new parking lots or building), landscaping, agricultural, or other use of plant property; (2) activities associated with transmission line maintenance (e.g., maintenance of access roads or removal of danger trees); and (3) changes to the appearance of nuclear power plants and transmission lines. Licensee renewal environmental reviews have shown that the appearance of nuclear power plants and transmission lines has not changed significantly over time; therefore, additional viewshed impacts to historic and cultural resources are not anticipated.

4.7.4 Analysis

4.7.4.1 Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to historic and cultural resources, and no further analysis is required.

4.7.4.2 Operational Activities

As presented in Section 3.8.5, no previous cultural resource surveys have been conducted on the ONS property; however, there have been nine cultural resource surveys documented within the 6-mile radius of the ONS property. There are no recorded cultural resources on the 510-acre ONS property. No structures on the ONS property have been evaluated for documentation through the Historic American Buildings Survey or the Historic American Engineering Record programs.

As discussed in Section 3.8.6, although no license renewal-related ground-disturbing activities have been identified, Duke Energy has guidance in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of a historic

resources consultation guidance document that protects known cultural resources as well as unknown cultural resources. Established processes for all activities that require a federal permit or use federal funding address the potential for impact to cultural resources by establishing procedures for all activities that require a federal permit or use federal funding and that have the potential to impact historic resources. Therefore, no adverse effects are anticipated to these sites during the ONS proposed SLR operating term.

The area within a 6-mile radius of the site is archaeologically sensitive (Table 3.8-1). Adverse impacts, however, would only occur to such sites as a result of soil-intrusive activities. Because Duke Energy has no plans to conduct such soil-intrusive activities at any location outside of the property boundary under a renewed license, no adverse effects to these archaeological sites would occur.

There are also NRHP-listed aboveground historic properties within a 6-mile radius of the site (Table 3.8-2). While these properties range from 0.35–4.87 miles away from ONS, because ONS is surrounded by rolling hills and a heavily wooded area (Figure 3.8-8), aesthetic and noise impacts to these resources as a result of the continued operations of ONS are not expected, and no adverse effects to the physical or historical integrity of these sites are anticipated.

As discussed above, no license renewal-related refurbishment or construction activities have been identified. No offsite NRHP-listed historic properties will be adversely impacted as a result of continued operations of ONS, and there are no plans to alter operations, expand existing facilities, or disturb additional land for the purpose of SLR. In addition, administrative procedural controls are in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. Therefore, Duke Energy concludes that there will be no adverse effects as a result of continued operation of ONS during the proposed ONS operating term, and additional mitigation measures beyond Duke Energy's existing procedural administrative controls are not warranted.

4.8 Socioeconomics

4.8.1 Employment and Income, Recreation and Tourism

4.8.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Although most nuclear plants have large numbers of employees with higher than average wages and salaries, employment, income, recreation, and tourism impact from continued operations and refurbishment associated with license renewal are expected to be small.

4.8.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.8.1.3 Background [GEIS Section 4.8.1.1]

Employees receive income from the nuclear power plant in the form of wages, salaries, and benefits. Employees and their families, in turn, spend this income on goods and services within the community thereby creating additional opportunities for employment and income. In addition, people and businesses in the community receive income for the goods and services sold to the power plant. Payments for these goods and services create additional employment and income opportunities in the community. The measure of a community's ability to support the operational demands of a power plant depends on the ability of the community to respond to changing socioeconomic conditions.

Some communities experience seasonal transient population growth due to local tourism and recreational activities. Income from tourism and recreational activities creates employment and income opportunities in the communities around nuclear power plants.

Nevertheless, the effects of nuclear power plant operations on employment, income, recreation, and tourism are ongoing and have become well established during the current license term for all nuclear power plants. The impacts from power plant operations during the license renewal term on employment and income in the region around each nuclear power plant are not expected to change from what is currently being experienced. In addition, tourism and recreational activities in the vicinity of nuclear plants are not expected to change as a result of license renewal.

4.8.1.4 Analysis

Information related to employment and income, and recreational facilities is discussed in Sections 3.9.1 and 3.9.7. In addition, as presented in Section 2.5, there are no plans to add regular full-time employees to support plant operations during the license renewal term. Because the site is situated in a heavily forested area and plant activities are set back from local roads and the lake, ONS does not visually impact local areas that have a high degree of visitor and recreational usage. No license renewal-related refurbishment activities have been identified, as presented in Section 2.3. Therefore, no changes in employment and income, and recreation and tourism during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that employment and income, and recreation and tourism impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.1). Based on Duke Energy's review, no new and significant information was identified as it relates to employment and income, and recreation and tourism, and further analysis is not required.

4.8.2 Tax Revenues

4.8.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Nuclear plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT), or tax payments on energy production. The amount

of tax revenue paid during the license renewal term as a result of continued operations and refurbishment associated with license renewal is not expected to change.

4.8.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.8.2.3 Background [GEIS Section 4.8.1.2]

Nuclear power plants and the workers who operate them are an important source of tax revenue for many local governments and public school systems. Tax revenues from nuclear power plants mostly come from property tax payments or other forms of payments such as payments in lieu of (property) taxes, or payments in lieu of taxes, although taxes on energy production have also been collected from several nuclear power plants. County and municipal governments and public school districts receive tax revenue either directly or indirectly through state tax and revenue-sharing programs.

Counties and municipal governments in the vicinity of a nuclear power plant also receive tax revenue from sales taxes and fees from the power plant and its employees. Changes in the number of workers and the amount of taxes paid to county, municipal governments, and public schools can affect socioeconomic conditions in the counties and communities around the nuclear power plant.

A review of license renewal applications received by the NRC has shown that license renewal-related refurbishment activities, such as steam generator and vessel head replacement, have not had a noticeable effect on the assessed value of nuclear plants, thus the NRC concluded in the 2013 GEIS that changes in tax revenues are not anticipated from future license renewal-related refurbishment activities.

The primary impact of license renewal would be the continuation or change in the amount of taxes paid by nuclear power plant owners to local governments and public school systems. The impact of nuclear plant operations on tax revenues in local communities and the impact that the expenditure of tax revenues has on the region are not expected to change appreciably from the amount of taxes paid during the current license term. Tax payments during the subsequent license renewal term would be similar to those currently being paid by each nuclear plant.

4.8.2.4 Analysis

Information related to tax revenues is discussed in Section 3.9.5. No license renewal-related refurbishment activities have been identified. Duke Energy's annual property taxes are expected to remain relatively constant throughout the license renewal term.

In the GEIS, the NRC determined that tax revenue impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.2). Based on Duke Energy's review, no new and

significant information was identified as it relates to tax revenues, and further analysis is not required.

4.8.3 Community Services and Education

4.8.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to local community and educational services would be small. With little or no change in employment at the licensee's plant, value of the power plant, payments on energy production, and payments in lieu of taxes expected during the license renewal term, community and educational services would not be affected by continued power plant operations.

4.8.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.8.3.3 Background [GEIS Section 4.8.1.3]

Any changes in the number of workers at a nuclear plant will affect the demand for public services from local communities. Environmental reviews conducted by the NRC have shown, however, that the number of workers at relicensed nuclear plants has not changed significantly because of license renewal, so the NRC concluded in the 2013 GEIS that demand-related impacts on community services, including public utilities, are no longer anticipated from future license renewals.

In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and the months of time that were conservatively analyzed in the 1996 GEIS, so the NRC concluded in the 2013 GEIS that significant impacts on community services are no longer anticipated. Because of the relatively short duration of refurbishment-related activities, workers are not expected to bring families and school-age children with them; therefore, impacts from refurbishment on educational services are also no longer anticipated.

Taxes paid by nuclear power plant owners support a range of community services, including public water, safety, fire protection, health, and judicial, social, and educational services. In some communities, tax revenues from power plants can have a noticeable impact on the quality of services available to local residents. Although many of the community services paid for by tax revenues from power plants are used by plant workers and their families, the impact of nuclear plant operations on the availability and quality of community services and education is SMALL and is not expected to change as a result of license renewal.

4.8.3.4 Analysis

Information related to community services and education is discussed in Section 3.9.4. No license renewal-related refurbishment activities have been identified, as presented in

Section 2.3. In addition, as presented in Section 2.5, there are no plans to add regular full-time employees to support plant operations during the proposed SLR operating term. As stated in Section 4.8.2.4, Duke Energy's annual property taxes are expected to remain relatively constant through the proposed SLR operating term, and no change is anticipated that would impact local community services and education.

In the GEIS, the NRC determined that community services and education impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.3). Based on Duke Energy's review, no new and significant information was identified as it relates to community services and education, and further analysis is not required.

4.8.4 Population and Housing

4.8.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to regional population and housing availability and value would be small. With little or no change in employment at the licensee's plant expected during the license renewal term, population and housing availability and values would not be affected by continued power plant operations.

4.8.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.8.4.3 Background [GEIS Section 4.8.1.4]

Socioeconomic impact analyses of resources (e.g., housing) affected by changes in regional population are based on employment trends at nuclear power plants. Population growth from increased employment and spending at a nuclear power plant is important because it is one of the main drivers of socioeconomic impacts. As previously discussed, however, employment levels at nuclear power plants are expected to remain relatively constant with little or no population growth or increased demand for permanent housing during the license renewal term. The operational effects on population and housing values and availability in the vicinity of nuclear power plants are not expected to change from what is currently being experienced, and no demand-related impacts are expected during the license renewal term.

The increased number of workers at nuclear power plants during regularly scheduled plant refueling and maintenance outages does create a short-term increase in the demand for temporary (rental) housing units in the region around each plant. However, because of the short duration and the repeated nature of these scheduled outages and the general availability of rental housing units (including portable trailers) in the vicinity of nuclear power plants, employment-related housing impacts have had little or no long-term impact on the price and

availability of rental housing. Refurbishment impacts would be similar to what is experienced during routine plant refueling and maintenance outages.

4.8.4.4 Analysis

Information related to population and housing is discussed in Section 3.9.2. No license renewal-related refurbishment activities have been identified, as presented in Section 2.3. As presented in Section 2.5, there are no plans to add regular full-time employees to support plant operations during the license renewal term.

In the GEIS, the NRC determined that population and housing impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.4). Based on Duke Energy's review, no new and significant information was identified as it relates to population and housing, and further analysis is not required.

4.8.5 Transportation

4.8.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to traffic volumes would be small.

4.8.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.8.5.3 Background [GEIS Section 4.8.1.5]

Transportation impacts depend on the size of the workforce, the capacity of the local road network, traffic patterns, and the availability of alternate commuting routes to and from the plant. Because most sites have only a single access road, there is often congestion on these roads during shift changes.

Transportation impacts are ongoing and have become well established during the current licensing term for all nuclear power plants. As previously discussed, it is unlikely that the number of permanent operations workers would increase at a nuclear power plant during the license renewal term. In addition, license renewal environmental reviews conducted by the NRC have shown that refurbishment activities, such as steam generator and vessel head replacement, have not required the numbers of workers and the months of time conservatively estimated in the 1996 GEIS. Consequently, the NRC concluded in the 2013 GEIS that employment at nuclear power plants during the license renewal term is expected to remain unchanged.

4.8.5.4 Analysis

Information related to transportation is discussed in Section 3.9.6. No license renewal-related refurbishment activities have been identified, as presented in Section 2.3. As presented in Section 2.5, there are no plans to add regular full-time employees to support plant operations during the license renewal term. In addition, as discussed in Section 3.9.6, roads with plant access in the immediate vicinity of ONS will continue to operate at acceptable LOS levels.

In the GEIS, the NRC determined that transportation impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC 2013a, Section 4.8.1.5). Based on Duke Energy's review, no new and significant information was identified as it relates to transportation, and further analysis is not required.

4.9 Human Health

4.9.1 Microbiological Hazards to the Public (Plants with Cooling Ponds or Canals, or Cooling Towers that Discharge to a River)

4.9.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers. Impacts would depend on site-specific characteristics.

4.9.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river, an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

4.9.1.3 Background [GEIS Section 4.9.1.1.3]

N. fowleri, which is the pathogenic strain of the free-living amoebae *Naegleria* spp., appears to be the most likely microorganism that may pose a public health hazard resulting from nuclear power plant operations. Increased populations of *N. fowleri* may have significant adverse impacts.

Since *Naegleria* concentrations in freshwater can be enhanced by thermal effluents, nuclear power plants that use cooling lakes, canals, ponds, or rivers experiencing low-flow conditions may enhance the populations of naturally occurring thermophilic organisms.

Changes in microbial populations and in the public use of water bodies might occur after the operating license is issued and the application for license renewal is filed. Other factors could also change, including the average temperature of the water, which could result from climate change that affected water levels and air temperature. Finally, the long-term presence of a

power plant might change the natural dynamics of harmful microorganisms within a body of water.

4.9.1.4 Analysis

ONS utilizes an open-cycle cooling system in which cooling water is withdrawn from Lake Keowee from its intake channel on the south side of the ONS plant, heated in the condensers, and returned to Lake Keowee through the discharge point on the northeast side of the ONS plant. The lake waters near the discharge area are open to the public. Activities in the area include recreational boating, fishing, and scuba diving. Lake Keowee has residential housing and public swimming areas as well.

ONS discharges heated cooling water at a depth of approximately 20 feet. The current NPDES permit establishes a maximum allowable discharge temperature of 100°F as a daily average, unless critical hydrological, meteorological, and electrical demand conditions apply. In such situations, the discharge temperature shall not be allowed to exceed 103°F. In the 2013 permit renewal application, Duke Energy requested the daily maximum value of 100°F to a 7-day average not to exceed 100°F. ONS operates in compliance with these thermal discharge limits and has not received any notices of violation for thermal exceedances.

Duke Energy monitors surface water temperatures at various locations in Lake Keowee at reports them in periodic CWA 316(a) demonstration reports. The closest station to the plant's discharge is approximately 200 meters from the discharge. The annual maximum measured surface water temperature at this location during the years 2006 to 2011 was 94.8°F which was similar to previously reported maximum annual values. Section 3.6.4.1 provides additional information on Lake Keowee water quality.

As noted in Section 3.10.1, *N. fowleri* infection is very rare and infection seldom occurs in water temperatures of 95°F or less. While the immediate discharge area could have temperatures above 95°F, this area is limited to the immediate vicinity of the discharge structure. The area is accessible by boat, but is located away from public boat ramps and swimming areas. The closest public lake shoreline access is at the onsite World of Energy facility (see Figure 3.1-1), but this facility does not offer boat access or a beach area. The closest public boat ramp is the Warpath boat ramp located in Pickens County (Duke 2019c). Duke Energy currently owns the closest offsite lakefront property, which is located across the SH-130 bridge over Lake Keowee and about 2,500 feet from the discharge structure (Oconee County 2019j). Thus, there is a limited area in the vicinity of the discharge structure where the thermal discharge could increase the water temperature to the range where *N. fowleri* could occur, albeit at a very low risk. However, its location away from public boating ramps and swimming beach areas, as well as the closest lake access being controlled by Duke Energy, mitigates public exposure. ONS's thermal discharge contribution to the very low risk of *N. fowleri* infection remains SMALL.

As done for the initial license renewal, Duke Energy consulted with SCDHEC for the agency's position and opinion regarding the public health implications of continued operation of ONS.

4.9.2 Electric Shock Hazards

4.9.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Electrical shock potential is of small significance for transmission lines that are operated in adherence with the NESC. Without a review of conformance with NESC criteria of each nuclear power plant's in-scope transmission lines, it is not possible to determine the significance of the electrical shock potential.

4.9.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

4.9.2.3 Background [GEIS Section 4.9.1.1.5]

Design criteria for nuclear power plants that limit hazards from steady-state currents are based on the NESC, adherence to which requires that utility companies design transmission lines so that the short-circuit current to ground produced from the largest anticipated vehicle or object is limited to less than 5 mA. With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received operating licenses with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for a reevaluation of this issue. The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear plants, is of SMALL significance for transmission lines that are operated in adherence with the NESC. Without a review of the conformance of each nuclear plant's transmission lines, within this scope of review with NESC criteria, it is not possible to determine the significance of the electrical shock potential generically.

4.9.2.4 Analysis

The in-scope transmission lines at ONS (Figure 2.2-4) are located completely within the ONS property boundary. Thus, the public risk is minimized due to restricted site access. The lines were constructed in compliance with the NESC in effect at the time, NESC 6th edition published in 1961. Because they are not part of the regional electrical grid, Duke Energy, rather than the transmission system operator, is responsible for these lines. Duke Energy controls the ground elevations under these transmission lines, which vehicles can be parked there, and what equipment can be permanently or temporarily installed there.

For the initial license renewal, Duke Energy confirmed that the in-scope transmission lines, as well as the 330 miles of transmission lines attributed to ONS when first licensed by NRC, were

compliant with the NESC. On this basis, the NRC concluded that the impact of the potential for electrical shock was SMALL, and mitigation was not warranted. (NRC 1999b, Section 4.2.1)

For SLR, a clearance evaluation was performed on all three lines from ONS building to ONS switchyard (i.e., the in-scope transmission lines). Each wire was modeled at its maximum operating temperature to ensure minimum required clearance values are met. The lines were determined to meet or exceed NESC clearance requirements. Duke Energy ensures that short-circuit current potential is less than 5 mA by enforcing minimal height clearances from equipment, vehicles, and other objects that could be parked are installed to the overhead in-scope transmission lines through.

Duke Energy implements work practices and training to identify and avoid shock hazards through its health and safety program which is documented in the corporate nuclear standards manual, and associated fleet and site-specific procedures for work with and near energized electrical equipment and lines, including addressing maintaining proper clearances.

Given that: (1) for current license renewal term, the NRC determined that the human health impact from electric shock hazards was SMALL; (2) the in-scope transmission lines are NESC compliant; and (3) routine maintenance, surveillance, and training procedures for work on and near the in-scope transmission lines provide assurance minimum ground clearances are maintained, the human health impact from electric shock hazards during the proposed SLR operating term would be SMALL.

4.10 Environmental Justice

4.10.1 Minority and Low-Income Populations

4.10.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

Impacts to minority and low-income populations and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in plant-specific reviews. See the NRC's policy statement on the treatment of environmental justice matters in NRC regulatory and licensing actions (69 FR 52040).

4.10.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(N)]

Applicants shall provide information on the general demographic composition of minority and low-income populations and communities (by race and ethnicity) residing in the immediate vicinity of the plant that could be affected by the renewal of the plant's operating license, including any planned refurbishment activities, and ongoing and future plant operations.

4.10.1.3 Background [GEIS Section 4.10.1]

Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of

impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the site and all are exposed to the same risks and hazards generated from operating a nuclear power plant.

Continued reactor operations and other activities associated with license renewal could have an impact on air, land, water, and ecological resources in the region around each nuclear power plant site, which might create human health and environmental effects on the general population. Depending on the proximity of minority and low-income populations in relation to each nuclear plant, the environmental impacts of license renewal could have a disproportionate effect on these populations.

The location and significance of environmental impacts may affect population groups that are particularly sensitive because of their resource dependencies or practices (e.g., subsistence agriculture, hunting, or fishing) that reflect the traditional or cultural practices of minority and low-income populations. The analysis of special pathway receptors can be an important part of the identification of resource dependencies or practices. Special pathways take into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the power plant sites in order to assess the risk of radiological exposure through subsistence consumption of fish, native vegetation, surface water, sediment, and local produce; the absorption of contaminants in sediments through the skin; and the inhalation of airborne particulates.

4.10.1.4 Analysis

4.10.1.4.1 Refurbishment Activities

As discussed in Section 2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to minority and low-income populations, and no further analysis is applicable.

4.10.1.4.2 Operational Activities

The consideration of environmental justice is required to assure that federal programs and activities will not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Duke Energy's analyses of the Category 2 issues defined in 10 CFR 51.53(c)(3)(ii) determined that environmental impacts from the continued operation of ONS during the proposed SLR operating term would either be SMALL or non-adverse. Therefore, high or adverse impacts to the general human population would not occur.

As described in Section 3.10, Duke Energy maintains an REMP. With this program, Duke Energy monitors important radiological pathways and considers potential radiation exposure to plant and animal life in the environment surrounding ONS. The results of the program indicate ONS has created no adverse environmental effects or health hazards. Therefore, no

environmental pathways have been adversely impacted and are not anticipated to be impacted during the ONS proposed SLR operating term.

Section 3.11.2 identifies the locations of minority and low-income populations as defined by NRR Office Instruction LIC-203 (NRC 2020a). Section 3.11.3 describes the search for subsistence-like populations near ONS, of which none were found. The figures accompanying Section 3.11.2 show the locations of minority and low-income populations within a 50-mile radius of ONS. None of those locations, when considered in the context of impact pathways described in this chapter, are expected to be disproportionately impacted.

Therefore, no disproportionately high and adverse impacts or effects on members of the public, including minority, low-income, or subsistence populations, are anticipated as a result of the proposed SLR.

4.11 Waste Management

4.11.1 Low-Level Waste Storage and Disposal

4.11.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment would remain small during the license renewal term.

4.11.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.11.1.3 Background [GEIS Section 4.11.1.1]

The NRC believes that the comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts on the environment will remain SMALL during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste (LLW) storage during the term of a renewed license and associated impacts would be SMALL. Nonradiological impacts on air and water would be negligible. The radiological and nonradiological environmental impacts of long-term disposal of LLW from any individual plant at licensed sites are SMALL. In addition, the NRC concludes that there is reasonable assurance that sufficient LLW disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

4.11.1.4 Analysis

Duke Energy will continue to manage and store LLRW onsite as described in Section 2.2.6, in accordance with NRC regulations, and dispose of LLRW in NRC-licensed treatment and disposal facilities during the proposed SLR operating term. As presented above, there are

comprehensive regulatory requirements in place and Duke Energy's compliance with these regulations and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the proposed SLR operating term. As discussed in Section 3.10.3, Duke Energy's annual reports for 2014–2018 indicate that doses to members of the public were in accordance with NRC and EPA radiation protection standards. No new and significant information has been identified for this issue. Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.11.2 Onsite Storage of Spent Nuclear Fuel

4.11.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

During the license renewal term, SMALL. The expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated onsite during the license renewal term with small environmental impacts through dry or pool storage at all plants.

For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are discussed in NUREG-2157 and as stated in § 51.23(b), shall be deemed incorporated into this issue.

4.11.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.11.2.3 Background [GEIS Section 4.11.1.2]

As discussed in Section 3.11.1.2 (GEIS), spent nuclear fuel is currently stored at reactor sites either in spent fuel pools or in ISFSIs. The storage of spent fuel in spent fuel pools was considered for each plant in the safety and environmental reviews at the construction permit and operating license stage. This onsite storage of spent fuel and high-level waste is expected to continue into the foreseeable future.

Interim storage needs vary among plants, with older units likely to lose pool storage capacity sooner than newer ones. Given the uncertainties regarding the final disposition of spent fuel and high-level waste, it is expected that expanded spent fuel storage capacity will be needed at all nuclear power plants.

NUREG-2157, *Generic EIS for Continued Storage of Spent Nuclear Fuel* (NRC 2014a, ES.12 and Table ES-3), concluded on a generic basis for all nuclear power plants that spent fuel can be stored onsite for 60 years following the license term with SMALL environmental effects.

4.11.2.4 Analysis

The additional 20 years of spent nuclear fuel generated during the proposed SLR operating term would be stored in the spent fuel pools until adequately cooled and then transferred to dry storage at an ISFSI. The NRC-licensed design and operation for spent fuel pools and ISFSIs

ensures that the increased volume in onsite storage can be safely accommodated with SMALL environmental effects. No new and significant information has been identified for this issue. Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.11.3 Offsite Radiological Impacts of Spent Nuclear Fuel and High-Level Waste Disposal

4.11.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

For the high-level waste and spent fuel disposal component of the fuel cycle, the EPA established a dose limit of 0.15 millisievert (mSv; 15 millirem) per year for the first 10,000 years and 1.0 mSv (100 millirem) per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada.

The NRC concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the NRC has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.

4.11.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.11.3.3 Background [GEIS Section 4.11.1.3]

As a result of the *New York v. NRC* decision, and pending the issuance of a generic EIS and revised Waste Confidence Decision and Rule, the NRC has revised the Category 1 issue, "Offsite radiological impacts of spent nuclear fuel and high-level waste disposal." This issue pertained to the long-term disposal of spent nuclear fuel and high-level waste, including possible disposal in a deep geologic repository. Although the Waste Confidence Decision and Rule did not assess the impacts associated with disposal of spent nuclear fuel and high-level waste in a repository, it did reflect the NRC's confidence, at the time, in the technical feasibility of a repository and when that repository could have been expected to become available. Without the analysis in the Waste Confidence Decision, the NRC cannot assess how long the spent fuel will need to be stored onsite. Therefore, the NRC reclassifies this GEIS issue from a Category 1 issue with no assigned impact level to an uncategorized issue with an impact level of uncertain. Moreover, the ultimate disposal of spent nuclear fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of license renewal.

4.11.3.4 Analysis

As indicated in Section 4.11.3.3, the NRC's GEIS analysis of the issue was tied to rulemaking for the waste confidence decision, which was pending in 2013 when the license renewal GEIS was issued. As part of the NRC's NEPA actions associated with the waste confidence decision,

the NRC reviewed the environmental impacts of away-from-reactor storage and the technical feasibility of disposal in a geologic repository in NUREG-2157, *Generic EIS for Continued Storage of Spent Nuclear Fuel* (NRC 2014a, Sections ES.7 and ES.16). In the final continued storage of nuclear spent fuel rulemaking, the listing and classification of license renewal issues found in 10 CFR 51, Subpart A, Appendix B, Table B-1 was revised to reclassify the impact determination for this issue as a Category 1 issue with no impact level assigned.

Since the NRC's review in NUREG-2157, the NRC has reviewed this issue of offsite radiological impacts of spent nuclear fuel and high-level waste disposal for new and significant information for several license renewal applicants. In the recent NRC review of this issue, it was indicated that the NRC is aware of no new and significant information on this issue (NRC 2020b). Duke Energy would comply with the applicable NRC, U.S. Department of Transportation, U.S. Department of Energy, and state regulatory controls for packaging and transportation of spent nuclear fuel to a licensed offsite disposal facility. Based on review of recent NRC documents and Duke Energy's compliance with packaging and transportation of spent nuclear fuel requirements and use of a licensed disposal facility, Duke Energy found no new and significant information and further analysis is not required.

4.11.4 Mixed Waste Storage and Disposal

4.11.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal would not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small.

4.11.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.11.4.3 Background [GEIS Section 4.11.1.4]

Mixed waste is regulated both by the EPA or the authorized state agency under RCRA and by the NRC or the agreement state agency under the AEA (Public Law 83-703). The waste is either treated onsite or sent offsite for treatment followed by disposal at a permitted landfill. The comprehensive regulatory controls and the facilities and procedures that are in place at nuclear power plants ensure that the mixed waste is properly handled and stored and that doses to and exposure to toxic materials by the public and the environment are negligible at all plants. License renewal will not increase the small but continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts from the long-term disposal of mixed waste at any individual plant at licensed sites are considered SMALL for all sites.

4.11.4.4 Analysis

ONS rarely generates mixed waste. Duke Energy has a conditional exemption for LLMW in accordance with 40 CFR 266, Subpart N, in place for any LLMW placed in storage at ONS storage units listed under the exemption. If generated, LLMW would be managed onsite in accordance with NRC regulations and the conditional exemption requirements. The waste would be transferred to an Energy Solutions licensed vendor for treatment and disposal. No new and significant information has been identified for this issue. Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.11.5 Nonradioactive Waste Storage and Disposal

4.11.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. No changes to systems that generate nonradioactive waste are anticipated during the license renewal term. Facilities and procedures are in place to ensure continued proper handling, storage, and disposal, as well as negligible exposure to toxic materials for the public and the environment at all plants.

4.11.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.11.5.3 Background [GEIS Section 4.11.1.5]

The management of hazardous wastes generated at all of these facilities, both onsite and offsite, is strictly regulated by the EPA or the responsible state agencies per the requirements of RCRA. As does any industrial facility, nuclear power plants and the rest of the uranium fuel cycle facilities also generate nonradioactive nonhazardous waste. These wastes are managed by following good housekeeping practices and are generally disposed of in local landfills permitted under RCRA Subtitle D regulations.

In the 1996 GEIS, the impacts associated with managing nonradioactive wastes at uranium fuel cycle facilities, including nuclear power plants, were found to be SMALL. It was indicated that no changes to nonradioactive waste generation would be anticipated for license renewal, and that systems and procedures are in place to ensure continued proper handling and disposal of the wastes at all plants.

4.11.5.4 Analysis

Management of nonradioactive waste is discussed in Section 2.2.7. Duke Energy manages its nonradioactive waste streams including hazardous, universal, and solid wastes according to Duke Energy procedures.

Duke Energy's management of its hazardous waste streams is in compliance with South Carolina Hazardous Waste Management Regulations. Duke Energy would continue to store and dispose of or recycle hazardous and nonhazardous wastes in accordance with EPA and state

regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the proposed SLR operating term.

The state of South Carolina also regulates infectious waste under South Carolina Infectious Waste Management Regulations, R. 61-105. ONS is registered as an infectious waste generator and complies with the regulations' requirement for the management of the waste.

As indicated in the 2013 GEIS, continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be SMALL. No new and significant information has been identified for this issue. Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.12 Cumulative Impacts

Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Cumulative impacts of continued operations and refurbishment associated with license renewal must be considered on a plant-specific basis. Impacts would depend on regional resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.

Requirement [10 CFR 51.53(c)(3)(ii)(O)]

Applicants shall provide information about other past, present, and reasonably foreseeable future actions occurring in the vicinity of the nuclear plant that may result in a cumulative effect.

Background [GEIS Section 4.13]

Actions to be considered in cumulative impact analyses include new and continuing activities, such as license renewal, that are conducted, regulated, or approved by a federal agency. The cumulative impacts analysis takes into account all actions, however minor, since impacts from individually minor actions may be significant when considered collectively over time. The goal of the analysis is to identify potentially significant impacts to improve decisions and move toward more sustainable development.

For some resource areas (e.g., water and aquatic resources), the contributions of ongoing actions within a region to cumulative impacts are regulated and monitored through a permitting process (e.g., NPDES) under state or federal authority. In these cases, it may be assumed that cumulative impacts are managed as long as these actions (facilities) are in compliance with their respective permits.

Analysis

Cumulative impacts analysis involves determining if there is an overlapping or compounding of the anticipated impacts of the continued operation of ONS during the proposed SLR operating term and past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions. For the purposes of this analysis, present actions are those related to current operation of ONS. Past actions at the ONS site and

surrounding area are accounted for in the affected environment sections for each resource area presented in Chapter 3 used as a baseline for impacts. Future actions are those actions that will continue into the proposed SLR operating term, and that are reasonably foreseeable firm plans with funding or funding to allow implementation during the remaining years of the current license term or 20-year proposed SLR operating term (generally plans that have moved beyond the conceptual phase). These criteria are in line with Regulatory Guide 4.2, Supplement 1, Rev. 1 (NRC 2013b), which states: "Future actions are those that are 'reasonably foreseeable'; that is, they are ongoing (and will continue into the future), are funded for future implementation, are included in firm, near-term plans, or generally have a high probability of being implemented."

The assessment first determines if the impacts of the continued operation of ONS during the proposed SLR operating term and any refurbishment activities could temporally and/or spatially combine with the impacts of other actions. Impacts that are for a limited duration, such as those that result from construction activities, would have to overlap in time for the impacts to combine. Impacts that require proximity to combine would have to be close enough to combine and occur at the same time to combine. The required proximity is resource-area dependent and would involve an overlapping of regions of influence. Next, the assessment determines if any combined impacts would be significant. Significant cumulative impacts could stem from an impact that may be SMALL by itself but could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. If a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

Ongoing activities at ONS and their impacts are detailed in Chapter 3 and the previous Chapter 4 sections. Two operational plant-wide changes of note implemented in the past include the change to a 24-month fuel cycle in 2011 and 2012 and the establishment of a lower minimum elevation (also called critical reservoir elevation) for Lake Keowee of 790 feet AMSL, effective December 1, 2019 (FERC 2016b, Article 402). Near future changes currently planned include the following (Duke 2020a):

- Thermal margin recapture uprates of 1.64 percent (15 MWe) per unit in 2021 and 2022.
- Installation of five new security towers.
- Installation of a watercraft barrier below Keowee Hydro Dam.

The ONS site has two ISFSIs. The original ISFSI is operated under a site-specific ISFSI license (No. SNM-2503) per 10 CFR Part 72, Subpart B, and the second ISFSI is operated under the ONS license per 10 CFR Part 72, Subpart K (Table 9.1-1). There are no current plans to further expand the ISFSI footprint. Expansion of storage capacity for spent nuclear fuel is a possibility to accommodate spent nuclear fuel from the proposed SLR term if the U.S. Department of Energy has not begun taking ownership of spent nuclear fuel. The need for expansion will be based on future storage configurations and a decision on future storage configurations is several years in the future. An expansion of the ISFSI was not considered as a project in cumulative impacts analysis because the need had not yet been determined. Furthermore,

plans and funding have not been identified for this yet-to-be-determined need. However, for a future ISFSI expansion, Duke Energy would identify candidate sites within ONS's NRC-licensed site (the host area required by 10 CFR 72.106, for an ISFSI general license under 10 CFR 72.210) and make a selection in consideration of regulations for, and commitments to, the protection of protected species, wetlands, and cultural resources.

Continuing activities for the area surrounding the ONS site are listed below. These ongoing activities were considered as present and future actions for the cumulative analysis.

- Keowee-Toxaway project operations (FERC No. 2503; Lake Keowee, Lake Jocassee, Keowee Hydro Station, Jocassee Hydroelectric Station) (see Section 3.6.1)
- Bad Creek project operations
- Recreational activities and operation of commercial marinas on Lake Keowee
- Residential activities at Lake Keowee
- Drinking water withdrawals from Lake Keowee
- Non-point discharges (e.g., run-off and malfunctioning septic systems) into Lake Keowee
- Forest management activities in Oconee County and Pickens County adjacent to the ONS site
- Traffic along SH-130 and SH-183
- Air emissions from stationary sources and vehicles

Section 3.1.4 identifies two federal projects in the ONS vicinity with future expansion plans. The first is Duke Energy's Bad Creek project. The 1,065-MWe Bad Creek project (FERC No. 2740) is located upstream from ONS. FERC has issued an order approving a non-capacity license amendment to add about 335 MWe generation ability to the Bad Creek pumped storage hydroelectric station by installing more efficient and powerful pump turbines, new transformers, generators, and circuit breakers. The Bad Creek project is operated to generate power in a pumped storage mode. Water is pumped from Lake Jocassee (lower reservoir) to Bad Creek (upper reservoir). The upper reservoir impounds the Bad Creek and West Bad Creek and has a surface area of approximately 318 acres and a usable storage capacity of approximately 30,229 acre-feet at full pool. The Bad Creek project's FERC license will expire on July 31, 2027. (USACE 2014).

The second federal project identified in Section 3.1.4 is the city of Walhalla's installation of a water intake on Lake Keowee. The city of Walhalla received a FERC license for the intake, and began construction in 2019. There are two other large municipal drinking water intakes on Lake Keowee, one for the town of Seneca and one for the city of Greenville (Section 3.9.3).

Section 3.1.4 also identifies three commercial developments planned in Oconee and Pickens counties. The Oconee County commercial developments, Horton Holding and RBC

Aerostructures, are located near Westminster, SC, southwest of the ONS site. Horton Holding manufactures fan drives, fans, and related components for the on-highway, off-highway, and industrial sectors. RBC Aerostructures plans to expand its existing facility. RBC Aerostructures is a provider of control rods and precision machined parts. These two developments would employ a total of 127 workers. (OEA 2019b; UA 2019) The Pickens County commercial venture, a frozen food processing facility, is located near Liberty, SC, east of the ONS site, and will employee an estimated 114 workers (UA 2019). These developments would all be more than 10 miles from the ONS site. Given the distance and employment levels, these developments would not be expected to have impacts that would be cumulative with ONS SLR impacts.

Additional considerations for future projects to contribute to cumulative impacts include population projections for the area and existing and future land use. As discussed in Section 3.11, the population of Oconee County is not expected to increase after 2025; the projection is that population will decrease. Pickens County had a reported population of 119,224 in 2010, and the projected permanent population for 2054 is expected to be 133,546, with an average annual growth percentage ranging from 0.07 to 0.58 percent.

Landward, the ONS site is surrounded by land owned by Duke Energy or an affiliate company. Lakeward, Duke Energy owns the closest land in all directions with the exception of some land in Pickens County located east of ONS and adjacent to Keowee Hydro, which is owned by Six Mile Rural Water District. Other land bordering Lake Keowee is owned by many and various landowners primarily for residences and residential development. The Six Mile Rural Water District's 76.2 acres are currently undeveloped, with the exception of the transmission corridor traversing the parcel. (qPublicnet 2019) The future land use map included in the Oconee County comprehensive plan (through 2030) shows all the land surrounding the ONS industrial site as residential (Oconee County 2018). The Pickens County comprehensive plan (through 2030) shows the Pickens County land along Lake Keowee as residential and indicates that this area is experiencing a high volume of growth (Pickens County 2016). Properties along the Lake Keowee shoreline are subject to Duke Energy's shoreline management plan for the Keowee-Toxaway project (Duke 2014a). The plan includes shoreline classification maps, classifications and lake-use restrictions, and shoreline management guidelines.

The following subsections address the potential for cumulative impacts by resource area.

4.12.1 Land Use and Visual Resources

The land use impact from continued operation of ONS was characterized as SMALL in Section 4.1 and none of the planned changes in ONS operations listed above would require additional land. Duke Energy does not plan to add regular full-time employees for the proposed SLR term and the changes in ONS operations listed above would not require additional regular full-time employees; therefore, offsite land use changes that could be attributable to the continued operation of ONS are not anticipated. The future land use designations for Oconee County and Pickens County do not indicate a change from current land uses surrounding the ONS site. The cumulative land use impact would be SMALL.

The continued use of existing structures associated with ONS would not alter their visual impact. Site structures offer limited offsite viewing opportunities and have minimal visual impact on neighboring properties (see Section 3.2.3). Of the planned changes in ONS operations listed above, the security towers could potentially be seen from offsite locations and the watercraft barrier would be visible from the Keowee River. These new structures would not be large, intrusive structures within the viewscape, and would be expected to blend in with the ONS visual presence. Prior to construction, the projects would be reviewed by ONS staff using the procedural environmental review checklist, which includes questions about the potential for the project to impact land, water, natural, and cultural resources. Other development along the Lake Keowee shoreline would be controlled by the shoreline management plan for the Keowee-Toxaway project, and other surrounding development would be subject to Oconee County's and Pickens County's comprehensive plans and zoning regulations. The cumulative impact to visual resources would be SMALL.

4.12.2 Air Quality and Noise

4.12.2.1 Air Quality

Section 3.3.3 discusses regional air quality and ONS air emission sources. All the counties within the 50-mile air quality region are in attainment with one exception that extends a short distance into the 50-mile radius. Also as presented in Section 3.3.3, there is one mandatory Class I federal area within the 50-mile region, and the Great Smoky Mountains National Park is 62 miles from the ONS site.

ONS's air emission sources include an auxiliary boiler and intermittently operated portable diesel generators and pumps. ONS maintains a conditional major operating air permit. The changes in ONS operations listed above could result in localized temporary air emissions from construction and demolition equipment. Implementing fugitive dust BMPs and maintaining portable equipment in proper working order will minimize air emissions. None of the planned future changes listed in Section 4.12 involve addition of a permanent air emissions source.

The future land use designations for Oconee and Pickens counties do not indicate a change from current land uses surrounding the ONS site. The area is expected to remain residential, and major air emission sources from industry are not expected. Further, as shown in Section 3.3.3, the proximity of the Class 1 federal areas will subject future industrial development to strict federal standards for air pollution control. The area will continue to experience air emissions from vehicles on the adjacent state roadways and recreational boating, and air emissions from ongoing projects which would be subject to state air permitting and regulations. The cumulative air quality impact would be SMALL.

4.12.2.2 Climate Change

Climate change can impact air quality as a result of changes in meteorological conditions. Ozone has been found to be particularly sensitive to climate change. Ozone is formed, in part,

from the chemical reaction of nitrogen oxides and volatile organic compounds in the presence of heat and sunlight. (EPA 2009)

ONS's air emission sources are minor and its annual air emissions, including nitrogen oxides (NO_x), are presented in Table 3.3-1. NO_x emissions from 2014 to 2018 ranged from approximately 6 to 10 tons. As a minor emitter of air pollutants, ONS's ability to contribute to ozone generation is also minor. It is important to note that the potential effects of climate change on air quality would occur irrespective of the incremental impact on air quality resulting from the continued operation of ONS.

With regard to carbon dioxide concentrations as a factor contributing to climate change, the fuel source for ONS does not produce carbon dioxide emissions or other GHG emissions, so the continued operation of ONS would avoid the millions of tons of GHGs that would be produced by a fossil fuel-fired alternative such as the NGCC presented in Chapter 7. While avoiding the generation of millions of tons of GHGs, the operation of ONS does emit GHGs directly and indirectly. ONS's direct GHGs result from stationary and portable fossil-fuel fired sources as discussed in Section 3.3.3 and stationary refrigeration appliances. Indirect GHGs originate from mobile combustion sources (e.g., employee vehicles, visitor vehicles, and delivery vehicles). Table 3.3-12 presents quantified annual GHG emissions from the sources at ONS.

Chlorofluorocarbon and hydrochlorofluorocarbon emissions from refrigerant sources can result from leakage, servicing, repair, or disposal of refrigerant sources. Chlorofluorocarbons and hydrochlorofluorocarbons are ozone-depleting substances regulated by the CAA under Title VI, "Stratospheric Ozone Protection." As discussed in Section 9.5.2.3, Duke Energy maintains a program to manage stationary refrigeration appliances at ONS to recycle, recapture, and reduce emissions of ozone-depleting substances.

The cumulative impact of a GHG emission source on climate is global. When compared to global emissions, which the NRC calculated to be 37,000 million metric tons of CO_2e per year based on reported 2016 global carbon dioxide emissions (NRC 2019b, Table 4-8), GHG emissions associated with ONS operations are negligible. The natural gas and combination alternatives' annual GHGs are higher by several orders of magnitude than those from the continued operation of a nuclear power plant (NRC 2019b, Table 4-7).

Given that the continued operation would contribute small emissions of air pollutants from minor air emission sources, the potential for climate change to exacerbate emissions and incrementally adversely impact air quality is SMALL. Moreover, continued operation of ONS avoids millions of tons of carbon dioxide from alternative fossil-fuel generation, which can be viewed as a net beneficial contribution to GHG emissions and climate change impacts during the proposed SLR term.

4.12.2.3 Noise

As described in Section 3.4, ONS produces noise due to plant operations and site activities. ONS occasionally produces loud noises, such as the noise from a limited-duration steam

release. As discussed above, ONS is surrounded by Duke Energy-owned land and the closest properties across Lake Keowee are Duke Energy-owned or undeveloped. The nearest residence is located approximately 1.03 miles north-northwest from the center point of the Unit 2 reactor containment (ONS 2019, Section 3.9). During the most recent 5 years (2014–2018), there have been no noise complaints received by Duke Energy as it relates to ONS plant operational and outage activities.

The surrounding land use presented above influences the noise sources and characterizes the noise environment as well. The future land use designations for Oconee and Pickens counties do not indicate a change from current land uses surrounding the ONS site. The area outside of the ONS industrial site is expected to remain residential. The cumulative noise impact would be SMALL.

4.12.3 Geology and Soils

Impacts to geology and soils could result from ground-disturbing activities and stormwater runoff. As discussed in Section 3.5.3.2, ONS maintains and implements a SWPPP that identifies potential sources of pollution that would reasonably be expected to affect the quality of stormwater, such as erosion, and identifies BMPs used to prevent or reduce the pollutants in stormwater discharges. ONS also has a procedure specific to ground-disturbing activities that requires that the appropriate permits be obtained and soil and erosion plans be developed prior to land disturbance. State regulations also require that construction activities resulting in land disturbance of greater than one acre must apply for permit coverage under the NPDES general permit for stormwater discharges from construction activities, permit No. SCR100000, which grants authorization to discharge under the SC Stormwater Management Program. ONS will submit a notice of intent and comply with the SCDHEC's general permit in effect at the time should any construction activities be required at the site, including the security towers project identified above as a future project.

Other construction in the surrounding area would also be subject to state regulations for obtaining stormwater permits and development of soil and erosion plans. Construction activities at Lake Keowee's shoreline would be subject to the requirements of Duke Energy's shoreline management plan for the Keowee-Toxaway project. The plan includes shoreline classification maps, classifications and lake-use restrictions, and shoreline management guidelines. Duke Energy requires all applicants desiring to stabilize shoreline or to plant shoreline or aquatic vegetation to obtain written authorization prior to beginning any activity/construction. Duke Energy uses its shoreline stabilization technique selection process to evaluate shoreline stabilization requests. (Duke 2014a)

Given compliance with the stormwater permit and soil and erosion plans by ONS and neighboring properties, as well as implementation of shoreline management guidelines, the cumulative impacts on geology and soil would be SMALL.

4.12.4 Water Resources

4.12.4.1 Surface Water

The geographic area in which cumulative impacts on surface water resources were evaluated includes the surface waters of the Keowee Toxaway project and the downstream Keowee River.

ONS withdraws and returns water to Lake Keowee for its cooling system and other process water needs. The withdrawal volume is permitted under a surface water withdrawal permit, and nearly all of the water is returned to Lake Keowee. (Once-through cooling typically consumes about 1 percent of the withdrawal volume.) Lake Keowee also has a low minimum elevation that governs the overall volume of the lake. Like ONS, other surface water withdrawals would be subject to permitting and thus permitting review by the SCDHEC. As identified above in Section 4.12, there are three municipal water intakes on Lake Keowee. Each of these would be subject to surface water withdrawal permitting, and the withdrawal volumes would equate to water consumption from the Keowee Toxaway project and the downstream Keowee River geographic area. None of the other future projects would involve additional surface water withdrawals from Lake Keowee. ONS is not a significant surface water user, so would contribute only minimally to surface water usage cumulative impacts.

As discussed in Section 3.6.4.1, Lake Keowee, Lake Jocassee, and several tributaries within the drainage basin appear on the SCDHEC's draft 2018 303(d) list of impaired waters. The sole known permitted discharge to Lake Keowee is ONS (Section 3.6.4.1). The discharge is permitted under an NPDES permit providing water quality limitations and monitoring requirements. ONS is in compliance with its NPDES permit and does not contribute to these impairments. ONS also operates in compliance with SCDHEC's general industrial stormwater permit and is assigned facility coverage number SCR000074 (Section 9.5.3). Ongoing activities for the geographic area would include non-point discharges to Lake Keowee. As discussed in Section 4.12.3, ONS has a SWPPP as well as a process to ensure future ground disturbance is conducted with the appropriate permits and BMPs. Construction along Lake Keowee would also be subject to stormwater permitting if more than one acre is disturbed; non-point discharges would be mitigated by shoreline management guidelines and proper functioning of residential septic systems.

ONS's NPDES permit for cooling water discharge also establishes both a maximum allowable discharge temperature and a limit for increases of water temperature between the intake and discharge. The maximum discharge temperature is 100°F as a daily average, unless critical hydrological, meteorological, and electrical demand conditions apply. In such situations, the discharge temperature shall not be allowed to exceed 103°F. The maximum temperature rise above the intake temperature is limited to 22°F when the intake temperature is greater than 68°F. In the 2013 permit renewal application, Duke Energy requested the daily maximum value of 100°F to a 7-day average not to exceed 100°F.

As part of a CWA Section 316(a) demonstration monitoring, Duke Energy monitors water temperatures at several Lake Keowee stations. The most recent report submitted to SCDHEC is

from 2013 and covers the years 2006–2011. The closest station to the plant's discharge is location 508, which is approximately 200 meters from the discharge. The annual maximum measured surface temperatures at location 508 in the years 2006–2011 ranged from 92.5°F in 2009 to 94.8°F in 2008. The annual maximum temperatures were similar to values reported in 1995 and 2007 reports. The report also noted that no exceedances of permit thermal limits occurred over the 2006–2011 period. The planned future thermal margin recapture uprates of 1.64 percent at each unit could result in an increase in discharge temperature. However, the discharge would still be required to meet the NPDES thermal limits in effect and demonstrate that the CWA Section 316(a) thermal variance is protective of the Lake Keowee aquatic ecological resources.

Given ONS's compliance with its current NDPES permits and assumed compliance with future NPDES permits and implementation of its land disturbance procedures, ONS's impact on surface water quality would be SMALL and would not significantly contribute to cumulative impacts to surface water quality.

4.12.4.2 Groundwater

As discussed in Section 3.6.3.2, the ONS property has three (3) groundwater drawdown wells for the standby shutdown facility and one groundwater recovery well for extraction of tritium-impacted groundwater, with total groundwater withdrawals for ONS of approximately 29.04 gpm (2011–2016). There are also several potable groundwater supply wells installed on the ONS property that have been abandoned or are being assessed for abandonment. It is not anticipated that groundwater withdrawal increases above the reported quantities will be required during the proposed SLR operating term (Section 4.5.3.4). The NRC considers groundwater withdrawals of less than 100 gpm as having a small impact on groundwater usage (10 CFR Part 51, Subpart A, Appendix B, Table B-1). The future projects for ONS identified above in Section 4.12 would not require additional groundwater withdrawals. The future land use for the surrounding area is residential, which would not have large groundwater withdrawals as might be required for industry. The primary water suppliers in Oconee County rely primarily on surface water supply, with one exception (Section 3.9.3). The future population of Oconee County is projected to decrease after 2025 (Table 3.11-3); therefore, an increase in groundwater usage in Oconee County for drinking water is not anticipated. ONS is not a significant groundwater user and would contribute only minimally to groundwater usage cumulative impacts.

ONS is the sole industrial land use in the vicinity and has a spill prevention, control and countermeasure (SPCC) plan in place to prevent and mitigate contamination of groundwater resources. In addition, the SCDHEC has regulations in place for underground storage tanks (USTs) that apply to ONS and other owners of USTs (e.g., gasoline stations) to protect soils and groundwater resources. The future land use anticipated for the area surrounding ONS is residential. Given implementation of ONS's SPCC plan, compliance with UST regulations by ONS and other UST owners, and the anticipated future land use surrounding ONS, the cumulative impact on groundwater quality would be SMALL.

4.12.4.3 Climate Change

Changes in temperature and precipitation from climate change would have important implications for surface water and near-surface groundwater. (As presented in Section 3.6.2, depths to water commonly range from 5 to 40 feet below the land surface, with an average fluctuation of about 3 to 5 feet.)

The potential impact of global climate change on the geographic area of ONS was viewed in light of projected impacts to the U.S. southeast in non-coastal areas. The U.S. Global Change Research Program projected the number of warm nights (days with minimum temperatures above 75°F) per year for the mid-21st century (2036–2065) for the ONS area range from 5-10 under the lower scenario and to 10-20 under the higher scenario as compared to 0-5 nights for the period 1976–2005 (USGCRP 2018, Figures 19.4 and 19.5). Climate change is also expected to intensify the hydrologic cycle and increase the frequency and severity of extreme events like drought and heavy rainfall (USGCRP 2018). The projected change in seasonal precipitation for the ONS area for 2070–2099 ranges from 0 to 10 percent for all the seasons except winter, which has a range of 10 to 20 percent change (USGCRP 2017, Figure 7.5).

As discussed above, ONS operations do not require significant surface water consumption or groundwater withdrawals, and ONS operates in compliance with its permits for water withdrawals and discharges. Given that the continued operation would have a small impact on water resources, the potential for climate change to exacerbate the impacts of ONS and other users of Lake Keowee on water resources is SMALL. Continued operation of ONS would avoid millions of tons of carbon dioxide from alternative fossil-fuel generation; thus, the continued operation of ONS could be viewed as a net beneficial contribution to climate change impacts.

4.12.5 Ecological Resources

4.12.5.1 Terrestrial

Section 4.6.5 assessed the effects on terrestrial resources from non-cooling system operations, concluding the impacts of continued ONS operation would be small. The impacts on terrestrial species from continued operation of a nuclear plant's cooling system are described as SMALL in the GEIS, and no new and significant information for Category 1 terrestrial resource environmental issues was identified (Section 5.2). The continued operation of ONS would be governed by ONS procedures and plans. As presented in Section 9.6, Duke Energy has administrative controls in place at ONS to ensure that operational changes or construction activities are reviewed and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. In addition, regulatory programs that the site is currently subject to, such as stormwater management, spill prevention, and herbicide usage, further minimize impacts to terrestrial resources. The environmental review procedure for ONS projects also specifically addresses potential impacts to ecological resources such as proximity of active and inactive nests, tree removal, and the presence of any protected species. ONS also has a site-specific work practice for wetlands and other environmentally sensitive areas that identifies the areas and requires that environmental staff be contacted prior to any

work in the area. Duke Energy also has a corporate avian protection plan. ONS maintains a migratory bird SPUT issued by the USFWS, which authorizes utilities to collect, transport, and temporarily possess migratory birds found dead on utility property, structures, and rights-of-way for avian mortality monitoring or disposal purposes.

As discussed in Section 3.7.8, nine federally listed species and seven state-listed species possibly occur within the 6-mile radius of ONS. Section 4.6.6.4 assessed the potential for continued operation of ONS to impact these protected species as well as species protected under the MBTA and BGEPA. The assessment concluded that Duke Energy has administrative controls in place at ONS to ensure the operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs and regulatory programs further serve to minimize impacts to any threatened, endangered, and protected species.

Other ongoing activities in the area would also be subject to SCDHEC regulations for stormwater and laws protecting threatened and endangered species and other protected species. Future land use for the surrounding area maintains the current designation as residential. Therefore, the continued operation of ONS including implementation of procedures and plans designed to avoid or mitigate potential impacts to ecological resources along with ongoing projects and activities in the surrounding area would have SMALL cumulative impacts to terrestrial ecology resources. As concluded in Section 4.6.6.4, the continued operation of the site would have no adverse effects to any federally or state-listed species, designated critical habitat, or EFH.

4.12.5.2 Aquatic

Section 4.6 assessed the potential impacts of continued operation on aquatic ecological resources from the impingement and entrainment of the cooling water intake on Lake Keowee and ONS's thermal discharge into Lake Keowee. As discussed in Section 4.6, Lake Keowee fishery resources have been monitored by various sources (USFWS, SCDNR, and Duke Energy) since 1972. Fish populations have remained stable and similar to those found in studies conducted since 1993, indicating that continued operation of ONS will have little to no long-term impact on fish populations in Lake Keowee. Further, as presented in Section 4.6, no deleterious impacts from thermal inputs were observed in the phytoplankton community in Lake Keowee and no large populations of thermally tolerant species or nuisance algae were observed. Lake Keowee was found to support small but highly diverse and viable phytoplankton communities throughout 2006–2011. No shifts toward dominance of thermally tolerant zooplankton taxa were observed, and the majority of abundant taxa from previous studies in the 1970s and 1989–2005 were still common and abundant during the later study period (2006–2011). Duke Energy has also monitored water temperatures below Keowee Dam since 2000, and the temperatures have demonstrated a stable pattern with temperatures never exceeding South Carolina's 90°F temperature standard (FERC 2016a).

As presented in Section 3.7.8, federally and state protected species possibly occur on the ONS site; however, none of these species are aquatic species. Also, the 6-mile vicinity does not include any EFH or EFHAs.

Of the planned future projects, watercraft barrier installation, and thermal discharge following implementation of the thermal uprates would occur in aquatic habitats. In addition, depending on the proximity to onsite streams and the Lake Keowee shoreline, installation of new security towers has the potential to impact aquatic habitat. These projects would undergo environmental review so the project could be designed to avoid or mitigate impacts to aquatic ecology and any required permits could be obtained. The planned future thermal margin recapture uprates of 1.64 percent at each unit could result in an increase in discharge temperature. However, the discharge would still be required to meet the NPDES thermal limits in effect and demonstrate that the CWA Section 316(a) thermal variance is protective of the Lake Keowee aquatic ecological resources. With continued application of the programs and procedures discussed above, the potential to impact aquatic habitat would be avoided or mitigated to small.

Other ongoing activities in the area would also be subject to SCDHEC regulations for stormwater and the shoreline management plan would protect Lake Keowee's water quality and aquatic species. Future land use for the surrounding area maintains the current designation as residential. Therefore, the continued operation of ONS, including implementation of procedures and plans designed to avoid or mitigate potential impacts to ecological resources along with ongoing projects and activities in the surrounding area, would have SMALL cumulative impacts to aquatic ecology resources. As concluded in Section 4.6.6.4, the continued operation of the site would have no adverse effects to any federally or state-listed species, DCH, or EFH. Furthermore, ONS would continue to monitor Lake Keowee's fishery as required under its current and future NDPES permits to assess the health of the fishery.

4.12.5.3 Climate Change

Changing temperature patterns and extreme weather events (e.g., floods and drought) can modify ecosystems. As presented in Section 4.12.4.3, the annual number of warm nights are projected to increase from 0-5 nights up to 20 nights under the higher climate change scenario during the SLR term and seasonal precipitation change for winter is projected to change up to 20 percent for the years following the SLR term.

The potential impact of global climate change on the geographic area of ONS was viewed in light of projected impacts to the U.S. southeast in non-coastal areas. Changing winter temperature extremes, wildfire patterns, sea levels, hurricanes, floods, droughts, and warming ocean temperatures are expected to redistribute species and greatly modify ecosystems across the southeastern states (USGCRP 2018). The U.S. Global Change Research Program has projected that temperatures will rise across the region. The projected number of warm nights (days with minimum temperatures above 75°F) per year for the mid-21st century (2036–2065) for the ONS area range from 5-10 under the lower scenario and to 10-20 under the higher scenario (USGCRP 2018, Figure 19.5). The projected change in seasonal precipitation for the ONS area for 2070–2099 ranges from 0 to 10 percent for all the seasons except winter, which has a range of 10 to 20 percent change (USGCRP 2017, Figure 7.5).

Climate change is also expected to intensify the hydrologic cycle and increase the frequency and severity of extreme events like drought and heavy rainfall (USGCRP 2018). Drought and

extreme heat can result in tree mortality and will transform southeastern forested ecosystems. Drought can also affect aquatic and wetland ecosystems. The prolonged inundation and lack of oxygen that result from extreme rainfall events can also result in mortality and large impacts to natural systems. In combination, future increases in both extreme drought and extreme rainfall are expected to transform many southeastern ecosystems. Rising temperatures and increases in the duration and intensity of drought are also expected to increase wildfire occurrence and reduce the effectiveness of prescribed fire. Ecological diversity in many southeastern natural systems is dependent upon fire. (USGCRP 2018)

Given that extreme climate change-related increases in temperature and changes in precipitation the SLR term are not projected for the SLR term and ONS would continue to comply with its NPDES permit for thermal discharge and monitoring the Lake Keowee fishery, the potential for climate change to exacerbate the impacts of ONS and other users of Lake Keowee on aquatic resources is SMALL.

4.12.6 Historic and Cultural Resources

As presented in Section 4.7, Duke Energy has guidance in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of a historic resources consultation guidance document that protects known cultural resources as well as unknown cultural resources. ONS also has a procedure specific to ground-disturbing activities that requires disruptive activity at the site be halted and Duke Energy staff be notified if any archeological areas are identified during construction or other land-disturbing activities. Duke Energy staff would consult with the SHPO to determine the appropriate steps to be taken prior to resuming the activity.

As detailed in Section 3.8, the area within a 6-mile radius of the site is archaeologically sensitive and there are NRHP-listed aboveground historic properties within a 6-mile radius of the site. These properties range from 0.35–4.87 miles away from ONS, and since ONS is surrounded by rolling hills and a heavily wooded area, aesthetic and noise impacts to these resources as a result of the continued operations of ONS are not expected, and no adverse effects to the physical or historical integrity of these sites are anticipated. Given the area is archaeologically sensitive and has NRHP-listed aboveground historic properties, other land disturbance in the area could impact historic and cultural resources. However, given Duke Energy's administrative procedural controls for management of cultural resources ahead of any future ground-disturbing activities at the plant, no adverse effects as a result of continued operation of ONS during the proposed ONS operating term are expected. Thus, ONS would control and minimize impacts to historic and cultural resources and would have a SMALL contribution to cumulative impacts.

4.12.7 Socioeconomics

The current workforce at ONS consists of 698 Duke Energy regular full-time employees (see Table 2.5-1) with approximately 800 to 900 contingent workers providing onsite support during outages (Section 9.5). The proposed SLR does not include additional workers (Section 4.8), so

the SMALL adverse impacts that are the result of workers' use of community services, education, and infrastructure including transportation would continue. The tax payments from the operating plant (Section 4.8) would continue along with the economic contributions of the plant's workforce. Duke Energy's property tax payments to Oconee County in FY 2019 were approximately $32 million, representing approximately 73 percent of the county's overall property tax revenues (Section 3.9.5). Thus, it is anticipated that significant beneficial socioeconomic impacts would continue during the proposed SLR operating term.

As mentioned above, in Section 4.12, the two future commercial ventures identified for Oconee County projected a total of 127 new jobs and the one for Pickens County would create a projected 114 new jobs. The estimated employed population in Oconee County and Pickens County in 2017 was 33,317 and 50,467 persons, respectively (Section 3.9.1). This new job creation would cause a very small percentage increase in overall employment.

Therefore, the socioeconomic conditions presented in Section 3.9 are expected to continue. The current socioeconomic conditions reflect the cumulative impacts of ONS and the surrounding area. Thus, given that: (1) the current conditions are designed to meet the community's needs; (2) additional workers at ONS are not anticipated; (3) future land use in the vicinity is designated as primarily residential; and (4) the identified future projects are projected to result in a very small percentage increase in overall employment, adverse cumulative impacts from the demand for and use of community services, education, and infrastructure would be SMALL. The significant beneficial economic impact of ONS as described in Section 3.9 would continue, contributing to the overall economy of the surrounding area.

4.12.8 Human Health

Radiological dose limits for protection of the public and workers have been developed by the EPA and the NRC to address the cumulative impacts of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. For this analysis, the region of influence is the surrounding 50-mile region.

As presented in Section 3.10.3, Duke Energy prepares annual radiological environmental operating reports and annual radiological effluent reports. The reports and trending studies indicate that ONS operations, including the ISFSIs located on the ONS site, have no significant radiological impact on the health and safety of the public. Effluents were in accordance with ONS's licenses and doses to members of the public did not exceed NRC and EPA radiation protection standards. Also as presented in Section 3.10.3, ONS's average annual individual occupational dose was well under the NRC exposure limit and the collective worker dose was also below average.

There are no other licensed or decommissioning nuclear reactors, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of ONS (NRC 2017; NRC 2019c; NRC 2019d; NRC 2019e; NRC 2019f; NRC 2019g).

Operating ONS for an additional 20-year period would not cause an increase in annual radioactive effluent releases. The cumulative impact of ONS operation and onsite dry storage of the accumulated SNF in the ISFSIs would be expected to be SMALL, because all routine releases and occupational exposure would be subject to federal and state regulations.

As for nonradiological human health impacts, ONS operations occur in areas restricted from the public and are carried out by ONS workers under a comprehensive occupational safety program. ONS's comprehensive occupational safety program addresses occupational hazards and ONS's average recordable injury and illness incident rate per 100 equivalent full-time workers for 2014–2018 is 0.05 which is comparable to the nuclear electric power generation industry's rate of 0.2 for 2017 (BLS 2018).

As discussed in Section 4.9.1.4, the microbiological impact to public health due to ONS's thermal discharge is SMALL. The thermal discharge from the ONS units following the thermal margin recapture uprates of 1.64 percent would not significantly elevate Lake Keowee's water temperature and is not likely to increase populations of thermophilic microorganisms beyond the levels normally occurring. ONS's in-scope transmission lines are also restricted from public access and do not pose a public human health risk. Compliance with NESC and ONS procedures minimize occupational risk from electrical shock hazards (Section 4.9.2.4). Therefore, cumulative impacts to human health from nonradiological hazards would be SMALL.

4.12.9 Waste Management

As presented in Section 4.11, the comprehensive regulatory controls in place for management of radiological waste and Duke Energy's compliance with these regulations and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the proposed SLR operating term. The NRC oversees the licensing of radiological waste treatment and disposal facilities. There are four facilities providing low-level radioactive waste disposal services in the United States (NRC 2017).

Duke Energy has programs in place to manage its hazardous and non-hazardous waste streams. Duke Energy also ensures that only licensed or permitted facilities are used for treatment and disposal of its waste streams. Continuation of existing systems and procedures to ensure proper storage and disposal during the proposed SLR operating term would allow the impacts to be SMALL. The other facilities within the 50-mile region of ONS are also required to comply with appropriate NRC, EPA, and state requirements for the management of radioactive and nonradioactive wastes. Thus, the cumulative waste management impact would be SMALL.

4.13 Impacts Common to all Alternatives: Uranium Fuel Cycle

4.13.1 Offsite Radiological Impacts—Individual Impacts from other than the Disposal of Spent Fuel and High-Level Waste

4.13.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts to the public from radiological exposures have been considered by the NRC in Table S-3 of this part. Based on information in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, would remain at or below the NRC's regulatory limits.

4.13.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.13.1.3 Background [GEIS Section 4.12.1.1]

The primary indicators of impact are the concentrations of radionuclides in the effluents from the fuel cycle facilities and the radiological doses received by a maximum exposed individual (MEI) on the site boundary or at some location away from the site boundary. The basis for establishing the significance of individual effects is the comparison of the releases in the effluents and the MEI doses with the permissible levels in applicable regulations. The analyses performed by the NRC in the preparation of Table S-3 and found in the 1996 GEIS indicate that as long as the facilities operate under a valid license issued by either the NRC or an agreement state, the individual effects will meet the applicable regulations. On the basis of these considerations, the NRC has concluded that the impacts on individuals from radioactive gaseous and liquid releases during the license renewal term would remain at or below the NRC's regulatory limits. Accordingly, the NRC concludes that offsite radiological impacts of the uranium fuel cycle (individual effects from sources other than the disposal of spent fuel and high-level waste) are SMALL.

4.13.1.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in Duke Energy's new and significant review as described in Chapter 5, and no new and significant information was identified as it relates to offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (Duke 1998, Section 4.19.2). Based on Duke Energy's finding of no new and significant information impacts to the public from radiological exposure would be SMALL, further analysis is not required.

4.13.2 Offsite Radiological Impacts—Collective Impacts from other than the Disposal of Spent Fuel and High-Level Waste

4.13.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The NRC concludes that the collective impacts are acceptable.

The NRC concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the NRC has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered Category 1.

4.13.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.13.2.3 Background [GEIS Section 4.12.1.1]

There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. All regulatory limits are based on individual doses. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits.

As discussed in the 1996 GEIS, despite the lack of definitive data, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. The NRC concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the NRC has not assigned a single level of significance for the collective effects of the fuel cycle, this issue was considered Category 1.

4.13.2.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in Duke Energy's new and significant review and no new and significant information was identified as it relates to offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (Duke 1998, Section 4.19.2). Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.13.3 Nonradiological Impacts of the Uranium Fuel Cycle

4.13.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant would be small.

4.13.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.13.3.3 Background [GEIS Section 4.12.1.1]

Data on the nonradiological impacts of the fuel cycle are provided in Table S-3. These data cover land use, water use, fossil fuel use, and chemical effluents. The significance of the environmental impacts associated with these data was evaluated in the 1996 GEIS on the basis of several relative comparisons. It was noted that the impacts associated with uses of all of the above resources would be SMALL. Any impacts associated with nonradiological liquid releases from the fuel cycle facilities would also be SMALL. As a result, the aggregate nonradiological impact of the uranium fuel cycle resulting from the renewal of an operating license for a plant would be SMALL, and it was considered a Category 1 issue in the 1996 GEIS.

4.13.3.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in Duke Energy's new and significant review and no new and significant information was identified as it relates to nonradiological impacts of the uranium fuel cycle. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (Duke 1998, Section 4.19.2). Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.13.4 Transportation

4.13.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts of transporting materials to and from uranium-fuel-cycle facilities on workers, the public, and the environment are expected to be small.

4.13.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.13.4.3 Background [GEIS Section 4.12.1.1]

The impacts associated with transporting fresh fuel to one 1,000 MWe model light-water reactor and with transporting spent fuel and radioactive waste (LLW and mixed waste) from that light water reactor are provided in Table S-4 in 10 CFR 51.52. Similar to Table S-3, and as indicated

in 10 CFR 51.52, every environmental report prepared for the construction permit stage of a commercial nuclear power plant must contain a statement concerning the transport of fuel and radioactive waste to and from the reactor. A similar statement is also required in LRAs. Table S-4 forms the basis of such a statement.

In 1999, the NRC issued an addendum to the 1996 GEIS in which the agency evaluated the applicability of Table S-4 to future license renewal proceedings, given that the spent fuel is likely to be shipped to a single repository (as opposed to several destinations, as originally assumed in the preparation of Table S-4) and given that shipments of spent fuel are likely to involve more highly enriched fresh fuel (more than 4 percent as assumed in Table S-4) and higher-burnup spent fuel (higher than 33,000 MWd/MTU as assumed in Table S-4). In the addendum, the NRC evaluated the impacts of transporting the spent fuel from reactor sites to the candidate repository at Yucca Mountain and the impacts of shipping more highly enriched fresh fuel and higher-burnup spent fuel. On the basis of the evaluations, the NRC concluded that the values given in Table S-4 would still be bounding, as long as the (1) enrichment of the fresh fuel was 5 percent or less, (2) burnup of the spent fuel was 62,000 MWd/MTU or less, and (3) higher-burnup spent fuel (higher than 33,000 MWd/MTU) was cooled for at least 5 years before being shipped offsite.

4.13.4.4 Analysis

The NRC did not revisit the radiological impact analysis of transporting spent nuclear fuel to away-from-reactor storage locations in the 2014 GEIS for continued storage of nuclear fuel, and again stated (as in 1999) that the radiological impact analysis can be found in Table S-4 (NRC 2014a, ES.16.2.16).

As stated earlier, the NRC considered the impacts of this issue to be SMALL, provided three conditions were met (NRC 2013a). Duke Energy reviewed its plans and protocols for future fuel enrichment specifications, fuel loading plans, and spent fuel cooling with regard to the three Table S-4 conditions. Duke Energy anticipates the maximum enrichment of fuel to be used at ONS during the proposed SLR operating term to be below 5 percent. As discussed in Section 2.2.1, for normal fuel batches, the average burnup level of the peak rod is not planned to exceed 62,000 MWd/MTU during the proposed SLR operating term. Furthermore, as presented in Section 2.2.6, spent fuel is stored onsite in spent fuel pools for adequate cooling prior to transfer to onsite dry storage.

The three Table S-4 conditions are met and the NRC's recent review of away-from-reactor storage of spent nuclear fuel indicated that the impacts continued to be considered SMALL. Duke Energy's new and significant review included compliance with the criteria of Table S-4, and concludes that there is no new and significant information related to transportation impacts of the uranium fuel cycle. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (Duke 1998, Section 4.19.2). Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.14 Termination of Nuclear Power Plant Operations and Decommissioning

4.14.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.

4.14.2 Requirement [10 CFR 51.53(c)(3)(iv)]

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

4.14.3 Background [GEIS Sections 4.12.2 and 4.12.2.1]

The impacts of decommissioning nuclear plants were evaluated by the NRC in NUREG-0586, *Generic Environmental Impact Statement for Decommissioning Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*.

This section describes and discusses the environmental consequences of terminating nuclear power plant operations and decommissioning, but the only impacts attributable to the proposed action (license renewal) are the effects of an additional 20 years of operations on the impacts of decommissioning. The majority of the impacts associated with plant operations would cease with reactor shutdown; however, some impacts would remain unchanged, while others would continue at reduced or altered levels. Some new impacts might also result directly from terminating nuclear power plant operations.

Terminating nuclear power plant operations would result in the cessation of actions necessary to maintain the reactor, as well as a significant reduction in the workforce. NRC presumes that terminating nuclear power plant operations would not immediately lead to the dismantlement of the reactor or other infrastructure, much of which would still be in use to support other units on site that continued to operate. Even for sites with just one unit, some facilities would remain in operation to ensure that the site was maintained in safe shutdown condition.

4.14.4 Analysis

Only the incremental increase in the impacts of termination of plant operations and decommissioning attributable to continued operation during the proposed SLR operating term is within the scope of this issue. The additional operating years would generate additional spent nuclear fuel to be managed during the decommissioning period as well as potentially greater volumes of radioactive waste or radioactive materials. As noted in Sections 2.3 and 2.5, the proposal to continue operation during an SLR operating term does not include construction of additional plant structures that would require decommissioning and additional workers are not anticipated for the license term that would incrementally increase socioeconomic impacts of termination of plant operations.

ONS would plan and conduct decommissioning activities in accordance with NRC-reviewed methods and evaluate anticipated environmental impacts to ensure that they are bounded by previously issued environmental assessments or are SMALL. Site restoration activities would be conducted in accordance with state and local regulations and permits, ensuring that environmental impacts would be SMALL.

The decommissioning impacts component of this issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (Duke 1998, Section 4.19.2). The 2013 license renewal GEIS combined several Category 1 decommissioning issues in the 1996 GEIS and added consideration of termination of plant operations (NRC 2013a). No new and significant information has been identified for this issue. Based on Duke Energy's finding of no new and significant information, further analysis is not required.

4.15 Severe Accident Mitigation Alternatives Analysis

4.15.1 Category 1 Issue—Design-Basis Accidents

The following Category 1 issue related to postulated accidents was reviewed for new and significant information that could make the generic finding as described in the GEIS (NRC 2013a) inapplicable to ONS: Issue 65—Design-basis accidents.

The GEIS (NRC 2013a) concluded that because a licensee is required to maintain the plant within acceptable design and performance criteria, including during any license renewal term, impacts from design-basis accidents would not be affected by changes in plant environment because such impacts (1) are based on calculated radioactive releases that are not expected to change; (2) are not affected by plant environment because they are evaluated for the hypothetical maximally exposed individual; and (3) have been previously determined acceptable.

The ONS review of new and significant information for the issue of design-basis accidents did not identify any new and significant information, and hence, no additional analysis is needed.

4.15.2 Category 2 Issue—Severe Accidents

In 1998, ONS submitted an application for OL renewal, which was approved in 2000. The original 40-year OL for ONS was thereby extended out to 60 years. As part of the initial license renewal process, a detailed evaluation of potential severe accident mitigation alternatives (SAMAs) was performed. A detailed cost-benefit analysis was performed on the 16 SAMAs that could not be qualitatively screened (Duke 1998). The cost/benefit analysis included development of a Level 3 probabilistic risk analysis (PRA) for ONS, which was used to calculate conditional offsite doses and property damage for each of the PRA source term categories (STCs). By calculating the reduction in STC frequencies for each potential SAMA, a bounding present value dollar benefit of each was determined, utilizing the guidance of NUREG/BR-0184

(NRC 1997). The benefit was then compared to a cost estimate for each, to complete the cost/benefit comparison. The conclusion of the analysis was that none of the proposed SAMAs were cost beneficial to ONS.

As part of the SLR process to renew the ONS ROL for another 20 years, the ONS PRA was again examined for insights. The purpose is to determine if there is any new and significant information regarding the SAMA analyses that would provide a significantly different picture of the impacts from postulated severe accidents during the second license renewal period. Over the course of plant operation, changes are made to the plant design, operation, and maintenance practices. Periodic updates to the ONS PRA have ensured that the PRA includes the relevant changes and continues to reflect the current plant design and operation. PRA updates also include updates to the plant-specific initiating event and equipment data utilized, and improvements in state-of-the-art analysis of severe accidents. Therefore, the PRA provides valuable insights into the risk significance of the plant changes over time.

The analyses follow the model approach in NEI 17-04 Revision 1 (NEI 2019) for determination of whether or not there is new and significant information regarding the SAMA analyses. The NRC staff has reviewed the NEI 17-04 Rev. 1 document and endorsed its interim use (NRC 2019h). For the ONS SLR, the consideration of new and significant changes since the time of the initial license renewal is consistent with the GEIS (NRC 2013a), Supplement 49 (NRC 2014b). Section 5.3.9 of GEIS Supplement 49 states the following:

> *New information is significant if it provides a seriously different picture of the impacts of the federal action under consideration. Thus, for mitigation alternatives such as SAMAs, new information is significant if it indicates that a mitigation alternative would substantially reduce an impact of the federal action on the environment. Consequently, with respect to SAMAs, new information may be significant if it indicated a given cost-beneficial SAMA would substantially reduce the impacts of a severe accident or the probability or consequences (risk) of a severe accident occurring.*

The implication of this statement is that "significance" is not solely related to whether or not a SAMA is cost beneficial, but depends also on a SAMA's potential to significantly reduce risk to the public (NEI 2019).

The following Category 2 issue (requirement) related to severe accidents has been defined by the NRC in 10 CFR 51.53(c)(3)(ii)(L):

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

The NRC finding regarding severe accidents is stated in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as follows:

> *The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.*

The NRC has ruled that when a plant qualifies for the exception from the requirement to consider SAMAs in 10 CFR 51.53(c)(3)(ii)(L), the exception operates to designate this Category 2 issue as the "functional equivalent" of a Category 1 issue (NRC 2013e). Accordingly, using a review process similar to that used for other Category 1 issues, Duke Energy reviewed this issue for new and significant information that would cause the following generic conclusions in the GEIS (NRC 2013a) concerning this issue to be inapplicable to ONS:

1. The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants.
2. License renewal ERs for plants for which SAMAs have been previously considered need not consider SAMAs again.

The assessment process for new and significant information related to the first conclusion included (1) interviews with subject matter experts on the validity of the conclusions 2013 GEIS as they relate to ONS; and (2) review of documents related to predicted impacts of severe accidents at ONS. Consideration was given to developments in plant operation and accident analysis that could have changed the assumptions made concerning severe accident consequences after SAMAs were previously evaluated by the NRC for ONS during initial license renewal (Duke 1998). Developments in the following areas included:

- New internal events information
- External events
- New source term information
- Power uprates
- Higher fuel burnup
- Other considerations including population increase and risk-beneficial plant changes implemented in response to recommendations from the Fukushima Daiichi Near Term Task Force.

No new and significant information was determined based on the following information. For developments in internal events, core damage frequency (CDF) at all three ONS units is comparable to the previous SAMA analysis that was performed (Duke 1998). Improvements in

safety at ONS since the previous SAMA analysis have been offset by refinements in PRA methodology and quality (e.g., treatment of dependency between human actions). Furthermore, the updated internal events models have been utilized in the quantitative PRA calculation that demonstrated the absence of any potentially significant SAMAs.

For developments in external events, since the first license renewal, ONS fire, seismic, high winds and external flood PRA models have been developed and have been utilized in the quantitative PRA calculation that demonstrated the absence of any potentially significant SAMAs.

Considering new source term information, the 2013 GEIS concluded that the NRC study from 1997 (NUREG/CR-6295) indicated that source term information and severe accident sequence timing is comparable to the 1996 GEIS. It has been determined that the previously evaluated source terms used to assess offsite radiological consequences of severe accidents are bounded by the conclusions of the 2013 GEIS and are considered appropriate for ONS SLR. For the new and significant evaluation, SAMAs were evaluated for impact on CDF and STC group frequencies if implemented. No SAMAs were found to reduce any STC group frequency by at least 50 percent.

Regarding power uprate, the 2013 GEIS concluded that the impact of power uprate on early fatalities can be gauged by the large early release frequency (LERF) metric. It found that LERF calculated by each licensee having a power uprate of greater than 10 percent only increased from minimal to 30 percent (with a mean of 10.5 percent), which was characterized as small to moderate change. Taken in combination with the other information presented in the 2013 GEIS, the NRC concluded that effects of such increases on risk and environmental impacts of severe accidents would be bounded by the 1996 GEIS, which used the 95 percent upper confidence bound values as the basis for estimating offsite consequences. At the time of the ONS SLR submittal, no power uprate has been implemented at ONS. Therefore, there is no new information affecting the SAMA evaluation related to power uprates.

Considering higher burnup fuel, the 2013 GEIS evaluates updated information for the effect of future increased fuel burnup on consequences of postulated accidents as predicted in the 1996 GEIS. Average peak rod fuel burn-up limit for each ONS unit during the terms of the extended licenses is not expected to exceed 62 gigawatt-days per metric ton of uranium (GWd/MTU). Taken in combination with the other information presented in the 2013 GEIS, the NRC concluded that increased peak fuel burnup from 60 to 75 GWd/MT would have effects on risk and environmental impacts of severe accidents that are bounded by the 1996 GEIS. Because ONS peak fuel burnup will be within the range considered by the NRC in the 2013 GEIS for PWRs, Duke Energy concludes that the conclusions of the 2013 GEIS are appropriate for the ONS SLR, and no new and significant information exists for ONS concerning the effect of peak fuel burnup on risk and environmental impacts of severe accidents.

Specifically, the current internal events CDF of 2.4E-5/year is approximately 8 percent lower than the internal events CDF of 2.6E-5/year from the first ONS LRA SAMA analysis. Regarding other considerations, changes have been implemented at the site in response to Fukushima

Daiichi Near Term Task Force recommendations and other plant-specific programs that are "risk-beneficial" but not credited in ONS PRA models. Therefore, the NRC conclusion in the 2013 GEIS that "the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small" is considered appropriate for the ONS SLR, is incorporated herein by reference, and no further analysis is needed.

Regarding the second conclusion, the subsections below describe the methodology and review of SAMAs to demonstrate there is no new and significant information.

4.15.3 Methodology for Evaluation of New and Significant SAMAs

4.15.3.1 Overview

The evaluations of the ONS SLR SAMAs are consistent with the NEI 17-04 Revision 1 methodology (NEI 2019), which describes a three-stage process for determining whether there is any "new and significant" information relevant to a previous SAMA analysis. In Stage 1, the SLR applicant uses PRA risk insights and/or risk model quantifications to estimate the percent reduction in the maximum benefit (MB) associated with (1) all unimplemented "Phase 2" SAMAs for the analyzed plant and (2) those SAMAs identified as potentially cost beneficial for other U.S. nuclear power plants and which are applicable to the analyzed plant. If one or more of those SAMAs are shown to reduce the MB by 50 percent or more, then the applicant must complete Stage 2 by developing updated averted cost-risk estimates for implementing those SAMAs. If the Stage 2 assessment confirms that one or more SAMAs reduce the MB by 50 percent or more, then the applicant must complete Stage 3 by performing a cost-benefit analysis for the "potentially significant" SAMAs identified in Stage 2. Applicants that are able to demonstrate through the Stage 1 screening process that there is no potentially significant new information are not required to perform the Stage 2 or Stage 3 evaluations. The application of the NEI 17-04 methodology is described in the following subsections.

4.15.3.1.1 Definitions of New and Significant Information

"New" information pertains to data used in a SAMA analysis that have changed or become available since the time the preceding SAMA analysis was performed.

There are some inputs to the SAMA analysis that are expected to change, or to potentially change, for all plants. These inputs include the following:

- Updated Level 3 model consequence results, which may be impacted by multiple inputs, including, but not limited to, the following:
    - Population
    - Value of farm and non-farm wealth
    - Core inventory (e.g., due to power uprate)
    - Evacuation timing and speed

    - Level 3 methodology updates
- NUREG/BR-0058 (NRC 2004) cost-benefit methodology updates.

In addition, other changes that could be considered "new information" are dependent on plant activities or site-specific changes. These types of changes include the following:

- Identification of a new hazard (e.g., a fault that was not previously analyzed in the seismic analysis).
- Updated plant risk model (e.g., a fire PRA that replaces the individual plant examination of external events [IPEEE] analysis).
    - Impacts of plant changes that are included in the plant risk models will be reflected in the model results and do not need to be assessed separately.
- Non-modeled modifications/changes to the plant.
    - Modifications determined to have no risk impact need not be included (e.g., replacement of the condenser vacuum pumps), unless they impact a specific input to SAMA (e.g., a new low-pressure turbine in the power conversion system that results in a greater net electrical output).

For risk model updates performed to reflect the latest PRA model state of the practice, it is noted that the actual physical plant risk may not have changed; however, because the best-estimate assessment or understanding of the risk has changed, it is considered new information.

The current ONS PRA models (internal and external events) were used to determine the level of significance of new information. These models include internal events, internal floods, seismic, fire, high winds and external flood PRAs. Consistent with the NEI methodology, these PRA models reflected the most up-to-date understanding of plant risk at the time of analysis (NEI 2019). As noted above, the criterion established for a potential SAMA being "significant" is if the MB calculated for ONS would be reduced by a factor of two or more if the SAMA were implemented. If it can be shown that a particular SAMA would not reduce the CDF or any of the significant Level 2 release category group frequencies in the models of record by more than a factor of two, then that particular SAMA could not reduce the MB by more than a factor of two. Therefore, that SAMA would not be considered potentially significant and would not be evaluated further in assessing the significance of new information. This criterion was applied to the SAMA screening evaluation presented in Section 4.15.4.

As seen in the subsequent sections, for ONS, all SAMAs were screened out either qualitatively or quantitatively in accordance with the NEI 17-04 methodology. Therefore, the "Stage 2" NEI 17-04 was not required, and the Level 3 PRA was not updated. Existence of a SAMA that would reduce MB by 50 percent or more and also be potentially cost-beneficial, would indicate the existence of "new and significant" information relevant to the previous SAMA analysis.

4.15.4 Analysis

4.15.4.1 Stage 1 Assessment: Overview

The list of candidate SAMAs for the ONS SLR was developed from plant-specific and industry sources. For the plant-specific portion, the initial ONS license renewal SAMA evaluation was examined to identify all SAMAs that could not be qualitatively screened, and that were found not to be cost effective. Evaluating these items is appropriate for determining if there is any new and significant information for ONS and the PRA since the time of the initial license renewal in regard to the potential plant improvements.

For evaluation of the industry sources, the GEIS (NRC 2013a) supplements were examined for SAMAs found to be potentially cost effective at plants similar to ONS. SAMAs found to be cost effective at similar plants (pressurized water reactors) were considered for their significance at ONS (NRC 2014b).

The list of SAMAs collected was evaluated qualitatively to screen any that are not applicable to ONS, or already exist at ONS. In addition, two other screening criteria were applied to eliminate SAMAs that have excessive cost. First, SAMAs were screened if they were found to reduce the ONS MB by >50 percent in the initial ONS license renewal, but also found not to be cost-effective due to high cost in the initial license renewal. This criterion is consistent with the NEI 17-04 guidance endorsed by the NRC (NRC 2019h), and recognizes the appropriate screening of SAMAs that have been demonstrated to have prohibitively large costs at ONS. Second, SAMAs related to creating a containment vent were screened due to excessive cost because this plant modification has been evaluated industry-wide and explicitly found to not be cost-effective in large/dry containments.

The remaining SAMAs were then grouped (if similar) based on similarities in mitigation equipment or risk-reduction benefits, and all were evaluated for the impact they would have on the ONS CDF and significant STC group frequencies if implemented. If any of the SAMAs reduced the total CDF or at least one significant STC group frequency by at least 50 percent, then the SAMA would be retained for a full Level 3 PRA evaluation of the reduction in MB. As seen below, all SAMAs were screened as not significant without the need to perform a Level 3 update.

The quantitative evaluations performed for this analysis use the ONS internal events, internal flood, internal fire, external floods, high winds, and seismic models. The internal events and flood models contain sufficient information to determine CDF and the significant STC groups (i.e., LERF and large late release frequency [LLRF]). The ONS fire, seismic, external flood and high wind models are capable of determining impacts to the CDF and LERF. This approach is sufficient to evaluate the SAMAs for new and significant information, given the bounding approach to the quantitative analyses and to the conservatism in the NEI approach. The LLRF contribution from significant external hazards is expected to be proportional to that of internal events, given the large free volume and robustness of the ONS containment. Containment phenomena such as steam overpressure and hydrogen detonation progress similarly regardless

of the initiating event. Significant releases from seismic events are generally due to building collapse or other events that would be assessed as LERF. For such external event phenomena, the LLRF contribution is therefore expected to be of a lower proportion to the CDF than that of the internal events PRA.

4.15.4.2 Stage 1 Assessment – Identification and Qualitative Screening

A total of 283 industry SAMAs were collected for evaluation in the ONS SLR. All but 45 were qualitatively screened using the criteria discussed in Section 4.15.4.1. ONS-specific SAMAs were reviewed to determine if they are still applicable. Plant modifications that removed the vulnerability or information on cost were considered for screening six ONS-specific SAMAs, and ten ONS-specific SAMAs were retained.

Table 4.15-1 presents the 45 industry SAMAs that were not qualitatively screened, combined with the ten ONS-specific SAMAs selected for further evaluation. The first column presents number assigned to each SAMA for tracking purposes. The second column identifies the plant from which the SAMA originated (i.e., ONS or an industry SAMA); the third column identifies the SAMA number from the source plant; the fourth column provides a description of the SAMA. The fifth column discusses the grouping of the SAMAs, and the sixth column identifies the name assigned to the SAMA group.

A total of 15 SAMA groups were identified for quantitative screening evaluation.

4.15.4.3 Stage 1 Assessment – Quantitative Screening

This section presents the quantitative screening of the ONS SAMAs. The NEI 17-04 methodology considers a potential SAMA to not be significant unless it reduces the MB by at least 50 percent. The Stage 1 quantitative screening process evaluates this using the criteria of total CDF and no STC frequency being reduced by at least 50 percent. Because the MB is the sum total of the contribution of each STC, if no STC decreases by at least 50 percent, then the total MB reduction cannot exceed 50 percent. However, the approach of evaluating every STC is not necessary to ensure the MB reduction is less than 50 percent. In reality, many individual STCs have a frequency that is insignificant, and while an insignificant STC could in theory be reduced by >50 percent, its impact on MB would be negligible. Additionally, many STCs have conditional offsite consequences that are negligible compared to the dominant STC groups (i.e., LERF and LLRF).

Therefore, the significant STC groups (i.e., LERF and LLRF) are examined for percentage reduction. If neither the total CDF, total LERF or total LLRF is reduced by >50 percent, then the MB is also not reduced by >50 percent. SAMAs screened in this manner will not be considered "significant" and will be conclusively screened as part of the Stage 1 assessment.

Table 4.15-2 presents the quantitative screening results from the bounding SAMA evaluations. The table presents the portion of the PRA model solved. The column "Adjusted Base" was created because some of the ONS models calculate frequency per calendar year and some per reactor critical year. The adjustment provides consistency across the models for this quantitative

evaluation. For internal events and internal floods, this includes CDF, LERF, and LLRF. For seismic, fire, high winds, and external floods, this includes CDF and LERF. Note that in some cases, the impact to the LLRF was a negative benefit. For example, adding water to a dry containment post-vessel failure, with no means of containment heat removal increases the potential for steam over-pressurization of containment.

As seen in Table 4.15-2, none of the bounding quantitative screening evaluations resulted in a reduction of total CDF, total LERF, or total LLRF greater than 50 percent. The evaluations were selected conservatively to provide assurance that they are bounding. In some cases, some measures (e.g., internal flooding LLRF) yielded an individual reduction greater than 50 percent, but internal flooding frequency is small compared to other hazard groups, and no SAMA resulted in a collective CDF or significant STC group frequency reduction of greater than 50 percent.

4.15.5 Conclusions

Appropriate qualitative screening criteria were applied to the industry SAMAs identified for consideration, eliminating many of the industry SAMAs from further consideration. For the remaining industry SAMAs and for the ONS-specific SAMAs to evaluate, a series of bounding quantitative analyses were performed. These analyses demonstrated that none of the SAMAs considered for quantitative evaluation would reduce the ONS MB by 50 percent or greater.

Therefore, consistent with the methodology presented in Section 4.15.3, it is concluded that there is no new and significant information that would alter the conclusions of the original SAMA analysis for ONS.

Table 4.15-1 Grouping of Related Industry and ONS-Specific SAMAs for Bounding Evaluation (Sheet 1 of 6)

ONS SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
244	Three Mile Island-1	10	Automate BWST refill.	Quantitatively evaluate. Determine the benefit from removing human action for BWST refill.	BWST
130	Indian Point 2	9	Create a reactor cavity flooding system.	Quantitatively evaluate. This SAMAs will help to significantly reduce or eliminate release frequency due to basemat melt through. Therefore, this SAMA is screened in and the benefit of flooding the containment to cover molten debris is evaluated.	DEB
142	Indian Point 3	7	Create a reactor cavity flooding system.		
298	Oconee	un-numbered 15 of 16	Install reactor cavity flooding system		
75	Calvert Cliffs 1, 2	34	Incorporate an alternate battery charging capability.	Quantitatively evaluate to determine the maximum benefit of additional power source.	EDG
173	Palisades	1	Install an additional EDG.		
198	Salem 1, 2	3	Install limited EDG crosstie capability between Salem 1 and 2.		
199	Salem 1, 2	4	Install fuel oil transfer pump on "C" EDG & provide procedural guidance for using "C" EDG to power selected "A" and "B" loads.		
267	Waterford 3	7	Install a gas turbine generator		
97	Cook 1, 2	160	Provide self-cooled ECCS seals.	Quantitatively evaluate. Determine the benefit from an additional source water to the HPSW to support HPI cooling support system.	HPI-PMP
286	Oconee	un-numbered 3 of 16	Install an automatic backup system or refill elevated water storage tank for high pressure injection (HPI) cooling		

Table 4.15-1 Grouping of Related Industry and ONS-Specific SAMAs for Bounding Evaluation (Sheet 2 of 6)

ONS SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
93	Cook 1, 2	39	Create/enhance hydrogen igniters with independent power supply. (GSI-189)	Quantitatively evaluate. The SAMA determines the benefit of eliminating containment failure due to hydrogen burn.	HYD
94	Cook 1, 2	40	Create a passive hydrogen ignition system.		
250	Three Mile Island-1	19	Install battery backed hydrogen igniters or a passive hydrogen ignition system.		
251	Three Mile Island-1	21	Install concrete shields to block direct pathways from the reactor pressure vessel (RPV) to the containment wall, and/or initiate containment flooding early in external flooding scenarios.	Quantitatively evaluate. Reduced liner melt-through fraction.	MELT
27	Braidwood 1, 2	19	Replace motor-operated valves (MOVs) in the RHR discharge line with valves that can isolate an ISLOCA event.	Quantitatively evaluate to determine the maximum benefit of SAMAs associated with ISLOCAs.	NO-ISLOCA
52	Byron 1, 2	19	Replace MOVs in the RHR discharge line with valves that can isolate an ISLOCA event.		
131	Indian Point 2	21	Install additional pressure or leak monitoring instrumentation for ISLOCA.		
132	Indian Point 2	22	Add redundant and diverse limit switches to each containment isolation valve.		
144	Indian Point 3	19	Install additional pressure or leak monitoring instrumentation for ISLOCA.		

Table 4.15-1 Grouping of Related Industry and ONS-Specific SAMAs for Bounding Evaluation (Sheet 3 of 6)

ONS SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
280	Wolf Creek	4	Proceduralize operator actions to perform local isolations of any valves that fail to close remotely in an interfacing system LOCA (ISLOCA).	Quantitatively evaluate to determine the maximum benefit of SAMAs associated with ISLOCAs.	
295	Oconee	un-numbered 12 of 16	Install additional containment bypass instrumentation		
143	Indian Point 3	18	Route the discharge from the MSSVs through a structure where spray water would condense the stream and remove fission products.	Quantitatively evaluate to determine the maximum benefit of SAMAs associated with SGTRs.	NO-SGTR
193	Prairie Island 1, 2	Added	Purchase of a gagging device that could be used to close a stuck-open SG safety valve on the ruptured steam generator prior to core damage in SGTR events.		
240	Sequoyah 1, 2	Added	Purchase or manufacture a "gagging device" that could be used to close a stuck-open steam generator safety valve for a SGTR event prior to core damage		
275	Waterford 3	71	Manufacture a gagging device for a steam generator safety valve and develop a procedure or work order for closing a stuck open valve		
296	Oconee	un-numbered 13 of 16	Add independent source of feedwater to reduce induced SGTR		

Table 4.15-1 Grouping of Related Industry and ONS-Specific SAMAs for Bounding Evaluation (Sheet 4 of 6)

ONS SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
2	Arkansas Nuclear One-2	AC/DC-16	Emphasize steps in plant recovery procedure following SBO.	Quantitatively evaluate. Determine the maximum benefit of additional training and guidance in restoring offsite power after SBO event.	OPR
14	Braidwood 1, 2	2	Replace the positive displacement pump with a self-cooled, auto-start pump.	Quantitatively evaluate to determine the maximum benefit of RCP seal cooling system.	RCP-SEAL
16	Braidwood 1, 2	4	Install "no leak" RCP seals.		
40	Byron 1, 2	2	Replace the positive displacement pump with a self-cooled, auto-start pump.		
42	Byron 1, 2	4	Install "no leak" RCP seals.		
99	Cook 1, 2	184	Provide a means to ensure RCP seal cooling so that RCP seal LOCAs are precluded for SBO events.		
117	Fort Calhoun	4	Implement procedure and operator-training enhancements to anticipate problems and cope with events that lead to loss of cooling to RCP seals.		
206	Salem 1, 2	10	Provide procedural guidance for faster cooldown on loss of RCP seal cooling.		

Table 4.15-1 Grouping of Related Industry and ONS-Specific SAMAs for Bounding Evaluation (Sheet 5 of 6)

ONS SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
239	Sequoyah 1, 2	Added	Automate the tripping of RCPs on loss of component cooling water	Quantitatively evaluate to determine the maximum benefit of RCP seal cooling system.	RCP-SEAL
243	Three Mile Island-1	8	Automate reactor coolant pump trip on high motor bearing cooling temperature.		
270	Waterford 3	26	Install improved reactor coolant pump seals		
1	Arkansas Nuclear One-1	129	Emphasize timely recirculation swapover in operator training.	Quantitatively evaluate to determine the maximum benefit of recirculation success.	RECIRC
19	Braidwood 1, 2	7	Establish flow to the residual heat removal (RHR) heat exchanger (HX) on RHR pump start.		
44	Byron 1, 2	7	Establish flow to the residual heat removal (RHR) HX on RHR pump start.		
71	Callaway	185	Automate initiation of CCW flow to the RHR heat exchangers.		
221	Sequoyah 1, 2	32	Automatically align emergency core cooling system to recirculation.		
226	Sequoyah 1, 2	105	Delay containment spray actuation after a large loss of coolant accident.		
227	Sequoyah 1, 2	106	Install automatic containment spray pump header throttle valves.		
230	Sequoyah 1, 2	249	High-volume makeup to the refueling water storage tank.		

Table 4.15-1 Grouping of Related Industry and ONS-Specific SAMAs for Bounding Evaluation (Sheet 6 of 6)

ONS SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
248	Three Mile Island-1	15	Automatic swap to recirculation mode.	Quantitatively evaluate to determine the maximum benefit of recirculation success.	RECIRC
291	Oconee	un-numbered 8 of 16	Install automatic swap over from injection to high pressure recirculation.		
287	Oconee	un-numbered 4 of 16	Install automatic swap of high pressure injection to spent fuel pool during a turbine building flood.	Quantitatively evaluate. During an internal flood event HPI suction can be aligned to the SFP.	SFP
273	Waterford 3	40	Use the fire water system as a backup source for the containment spray system.	Quantitatively evaluate the maximum benefit for SAMAs related to improved containment/recirc spray systems.	SPRAY
293	Oconee	un-numbered 10 of 16	Install independent containment spray systems.		
80	Calvert Cliffs 1, 2	74	Automate demineralized water (DW) makeup to condensate storage tank.	Quantitatively evaluate. At ONS the primary water source for EFW is the UST, and there are manual actions to refill UST or swap EFW suction. ONS has added backup systems such as PSW, but this is not automatic. Evaluate long term water supply without manual action.	UST
284	Oconee	un-numbered 1 of 16	Strengthen east and west penetration rooms, and borated water storage tank (BWST) to withstand tornado winds.	Quantitatively evaluate identified high wind vulnerabilities.	WIND
289	Oconee	un-numbered 6 of 16	Install protective barrier around upper surge tanks for tornadoes.		
290	Oconee	un-numbered 7 of 16	Upgrade 4,160-volt switchgear in turbine building to withstand F4 intensity tornadoes.		

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 1 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
SAMA BWST Unit 1 Model			
Int. Events CDF	2.405E-05	2.241E-05	6.82%
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.563E-05	1.39%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.136E-05	0.00%
Seismic CDF	3.273E-05	3.258E-05	0.45%
Combined CDF	**1.258E-04**	**1.238E-04**	**1.59%**
Int. Events STC LERF	4.774E-07	4.774E-07	0.00%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.823E-07	1.12%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.525E-06	0.00%
Seismic STC LERF	1.363E-05	1.362E-05	0.07%
Combined STC LERF	**1.894E-05**	**1.893E-05**	**0.07%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.398E-07**	**0.00%**
SAMA BWST Unit 2 Model			
Int. Events CDF	2.405E-05	2.244E-05	6.69%
Int. Flood CDF	2.032E-06	2.032E-06	0.00%
High Winds CDF	1.901E-05	1.875E-05	1.37%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.465E-05	0.00%
Seismic CDF	3.273E-05	3.258E-05	0.45%
Combined CDF	**1.328E-04**	**1.307E-04**	**1.52%**
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	2.834E-08	2.834E-08	0.00%
High Winds STC LERF	3.220E-07	3.187E-07	1.02%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.308E-06	0.00%
Seismic STC LERF	1.363E-05	1.362E-05	0.07%
Combined STC LERF	**1.877E-05**	**1.876E-05**	**0.07%**

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 2 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	2.671E-08	2.671E-08	0.00%
Combined STC LLRF	**1.664E-07**	**1.664E-07**	**0.00%**
SAMA BWST Unit 3 Model			
Int. Events CDF	2.405E-05	2.241E-05	6.82%
Int. Flood CDF	1.900E-06	1.900E-06	0.00%
High Winds CDF	1.732E-05	1.713E-05	1.10%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.300E-05	0.00%
Seismic CDF	3.273E-05	3.258E-05	0.45%
Combined CDF	**1.092E-04**	**1.073E-04**	**1.81%**
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	3.159E-08	3.159E-08	0.00%
High Winds STC LERF	2.922E-07	2.894E-07	0.96%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.769E-06	0.00%
Seismic STC LERF	1.363E-05	1.362E-05	0.07%
Combined STC LERF	**1.720E-05**	**1.719E-05**	**0.07%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	3.936E-08	3.936E-08	0.00%
Combined STC LLRF	**1.791E-07**	**1.791E-07**	**0.00%**
SAMA DEB Unit 1 Model			
Combined CDF	**1.258E-04**	**1.258E-04**	**0.00%**
Int. Events STC LERF	4.774E-07	4.754E-07	0.42%
Int. Flood STC LERF	1.585E-08	7.579E-09	52.18%
High Winds STC LERF	2.855E-07	2.681E-07	6.09%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	3.636E-06	19.65%
Seismic STC LERF	1.363E-05	1.355E-05	0.60%
Combined STC LERF	**1.893E-05**	**1.794E-05**	**5.28%**
Int. Events STC LLRF	1.397E-07	1.386E-07	0.79%
Int. Flood STC LLRF	1.476E-10	1.409E-10	4.58%
Combined STC LLRF	**1.398E-07**	**1.387E-07**	**0.79%**

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 3 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
SAMA DEB Unit 2 Model			
Combined CDF	**1.327E-04**	**1.327E-04**	**0.00%**
Int. Events STC LERF	4.776E-07	4.756E-07	0.42%
Int. Flood STC LERF	2.834E-08	1.981E-08	30.09%
High Winds STC LERF	3.220E-07	3.060E-07	4.97%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	3.374E-06	21.70%
Seismic STC LERF	1.363E-05	1.355E-05	0.60%
Combined STC LERF	**1.877E-05**	**1.772E-05**	**5.56%**
Int. Events STC LLRF	1.397E-07	1.398E-07	-0.07%
Int. Flood STC LLRF	2.671E-08	2.633E-08	1.44%
Combined STC LLRF	**1.664E-07**	**1.661E-07**	**0.17%**
SAMA DEB Unit 3 Model			
Combined CDF	**1.092E-04**	**1.092E-04**	**0.00%**
Int. Events STC LERF	4.776E-07	4.756E-07	0.42%
Int. Flood STC LERF	3.159E-08	2.268E-08	28.21%
High Winds STC LERF	2.922E-07	2.618E-07	10.40%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.090E-06	24.53%
Seismic STC LERF	1.363E-05	1.355E-05	0.60%
Combined STC LERF	**1.720E-05**	**1.640E-05**	**4.67%**
Int. Events STC LLRF	1.397E-07	1.398E-07	-0.07%
Int. Flood STC LLRF	3.936E-08	3.776E-08	4.06%
Combined STC LLRF	**1.791E-07**	**1.776E-07**	**0.84%**
SAMA EDG Unit 1 Model			
Int. Events CDF	2.405E-05	2.335E-05	2.91%
Int. Flood CDF	1.583E-06	1.551E-06	2.02%
High Winds CDF	1.585E-05	1.201E-05	24.22%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	4.753E-05	7.45%
Seismic CDF	3.273E-05	3.256E-05	0.51%
Combined CDF	**1.258E-04**	**1.173E-04**	**6.81%**
Int. Events STC LERF	4.774E-07	4.617E-07	3.29%
Int. Flood STC LERF	1.585E-08	1.553E-08	2.03%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 4 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
High Winds STC LERF	2.855E-07	2.021E-07	29.21%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.227E-06	6.59%
Seismic STC LERF	1.363E-05	1.362E-05	0.11%
Combined STC LERF	**1.893E-05**	**1.852E-05**	**2.18%**
Int. Events STC LLRF	1.397E-07	7.580E-08	45.74%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**7.595E-08**	**45.69%**
SAMA EDG Unit 2 Model			
Int. Events CDF	2.405E-05	2.335E-05	2.91%
Int. Flood CDF	2.032E-06	1.958E-06	3.65%
High Winds CDF	1.901E-05	1.515E-05	20.29%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.174E-05	5.33%
Seismic CDF	3.273E-05	3.256E-05	0.51%
Combined CDF	**1.327E-04**	**1.250E-04**	**5.81%**
Int. Events STC LERF	4.776E-07	4.693E-07	1.74%
Int. Flood STC LERF	2.834E-08	2.742E-08	3.25%
High Winds STC LERF	3.220E-07	2.536E-07	21.24%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.068E-06	5.57%
Seismic STC LERF	1.363E-05	1.362E-05	0.11%
Combined STC LERF	**1.877E-05**	**1.843E-05**	**1.78%**
Int. Events STC LLRF	1.397E-07	7.580E-08	45.74%
Int. Flood STC LLRF	2.671E-08	2.249E-08	15.82%
Combined STC LLRF	**1.664E-07**	**9.829E-08**	**40.94%**
SAMA EDG Unit 3 Model			
Int. Events CDF	2.405E-05	2.335E-05	2.91%
Int. Flood CDF	1.900E-06	1.865E-06	1.83%
High Winds CDF	1.732E-05	1.340E-05	22.63%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.097E-05	6.14%
Seismic CDF	3.273E-05	3.256E-05	0.51%
Combined CDF	**1.092E-04**	**1.024E-04**	**6.27%**

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 5 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Events STC LERF	4.776E-07	4.619E-07	3.29%
Int. Flood STC LERF	3.159E-08	3.097E-08	1.97%
High Winds STC LERF	2.922E-07	2.223E-07	23.92%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.647E-06	4.40%
Seismic STC LERF	1.363E-05	1.362E-05	0.11%
Combined STC LERF	**1.720E-05**	**1.698E-05**	**1.30%**
Int. Events STC LLRF	1.397E-07	7.580E-08	45.74%
Int. Flood STC LLRF	3.936E-08	2.953E-08	24.98%
Combined STC LLRF	**1.791E-07**	**1.053E-07**	**41.18%**
SAMA HPI-PMP Unit 1 Model			
Int. Events CDF	2.405E-05	2.399E-05	0.25%
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.579E-05	0.38%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.133E-05	0.05%
Seismic CDF	3.273E-05	3.244E-05	0.89%
Combined CDF	**1.258E-04**	**1.254E-04**	**0.35%**
Int. Events STC LERF	4.774E-07	4.768E-07	0.13%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.850E-07	0.18%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.522E-06	0.06%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.893E-05**	**1.893E-05**	**0.02%**
Int. Events STC LLRF	1.397E-07	1.336E-07	4.37%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.337E-07**	**4.36%**
SAMA HPI-PMP Unit 2 Model			
Int. Events CDF	2.405E-05	2.399E-05	0.25%
Int. Flood CDF	2.032E-06	2.032E-06	0.00%
High Winds CDF	1.901E-05	1.896E-05	0.26%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.459E-05	0.12%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 6 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Seismic CDF	3.273E-05	3.244E-05	0.89%
Combined CDF	**1.327E-04**	**1.323E-04**	**0.35%**
Int. Events STC LERF	4.776E-07	4.770E-07	0.13%
Int. Flood STC LERF	2.834E-08	2.834E-08	0.00%
High Winds STC LERF	3.220E-07	3.215E-07	0.16%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.304E-06	0.11%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.877E-05**	**1.876E-05**	**0.03%**
Int. Events STC LLRF	1.397E-07	1.336E-07	4.37%
Int. Flood STC LLRF	2.671E-08	2.632E-08	1.47%
Combined STC LLRF	**1.664E-07**	**1.599E-07**	**3.90%**
SAMA HPI-PMP Unit 3 Model			
Int. Events CDF	2.405E-05	2.399E-05	0.25%
Int. Flood CDF	1.900E-06	1.900E-06	0.00%
High Winds CDF	1.732E-05	1.727E-05	0.29%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.294E-05	0.17%
Seismic CDF	3.273E-05	3.244E-05	0.89%
Combined CDF	**1.092E-04**	**1.088E-04**	**0.42%**
Int. Events STC LERF	4.776E-07	4.770E-07	0.13%
Int. Flood STC LERF	3.159E-08	3.159E-08	0.00%
High Winds STC LERF	2.922E-07	2.916E-07	0.21%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.764E-06	0.20%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.720E-05**	**1.719E-05**	**0.04%**
Int. Events STC LLRF	1.397E-07	1.336E-07	4.37%
Int. Flood STC LLRF	3.936E-08	3.936E-08	0.00%
Combined STC LLRF	**1.791E-07**	**1.730E-07**	**3.41%**
SAMA MELT Unit 1 Model			
Combined CDF	1.258E-04	1.258E-04	0.00%
Combined STC LERF	1.893E-05	1.875E-05	1.0%
Combined STC LLRF	1.398E-07	1.398E-07	0.00%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 7 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
SAMA MELT Unit 2 Model			
Combined CDF	1.327E-04	1.327E-04	0.00%
Combined STC LERF	1.877E-05	1.858E-05	1.0%
Combined STC LLRF	1.664E-07	1.664E-07	0.00%
SAMA MELT Unit 3 Model			
Combined CDF	1.092E-04	1.092E-04	0.00%
Combined STC LERF	1.720E-05	1.703E-05	1.0%
Combined STC LLRF	1.791E-07	1.791E-07	0.00%
SAMA NO-ISLOCA Unit 1 Model			
Int. Events CDF	2.405E-05	2.389E-05	0.67%
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.585E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.136E-05	0.00%
Seismic CDF	3.273E-05	3.269E-05	0.14%
Combined CDF	**1.258E-04**	**1.256E-04**	**0.16%**
Int. Events STC LERF	4.774E-07	3.189E-07	33.20%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.855E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.525E-06	0.00%
Seismic STC LERF	1.363E-05	1.361E-05	0.13%
Combined STC LERF	**1.893E-05**	**1.876E-05**	**0.93%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.398E-07**	**0.00%**
SAMA NO-ISLOCA Unit 2 Model			
Int. Events CDF	2.405E-05	2.389E-05	0.67%
Int. Flood CDF	2.032E-06	2.032E-06	0.00%
High Winds CDF	1.901E-05	1.901E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.465E-05	0.00%
Seismic CDF	3.273E-05	3.269E-05	0.14%
Combined CDF	**1.327E-04**	**1.325E-04**	**0.15%**

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 8 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Events STC LERF	4.776E-07	3.192E-07	33.17%
Int. Flood STC LERF	2.834E-08	2.834E-08	0.00%
High Winds STC LERF	3.220E-07	3.220E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.308E-06	0.00%
Seismic STC LERF	1.363E-05	1.361E-05	0.13%
Combined STC LERF	**1.877E-05**	**1.859E-05**	**0.94%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	2.671E-08	2.671E-08	0.00%
Combined STC LLRF	**1.664E-07**	**1.664E-07**	**0.00%**
SAMA NO-ISLOCA Unit 3 Model			
Int. Events CDF	2.405E-05	2.389E-05	0.67%
Int. Flood CDF	1.900E-06	1.900E-06	0.00%
High Winds CDF	1.732E-05	1.732E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.300E-05	0.00%
Seismic CDF	3.273E-05	3.269E-05	0.14%
Combined CDF	**1.092E-04**	**1.090E-04**	**0.19%**
Int. Events STC LERF	4.776E-07	3.192E-07	33.17%
Int. Flood STC LERF	3.159E-08	3.159E-08	0.00%
High Winds STC LERF	2.922E-07	2.922E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.769E-06	0.00%
Seismic STC LERF	1.363E-05	1.361E-05	0.13%
Combined STC LERF	**1.720E-05**	**1.702E-05**	**1.03%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	3.936E-08	3.936E-08	0.00%
Combined STC LLRF	**1.791E-07**	**1.791E-07**	**0.00%**
SAMA NO-SGTR Unit 1 Model			
Int. Events CDF	2.405E-05	2.134E-05	11.27%
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.585E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.136E-05	0.00%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 9 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.258E-04**	**1.231E-04**	**2.15%**
Int. Events STC LERF	4.774E-07	2.931E-07	38.60%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.849E-07	0.21%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	2.901E-06	35.90%
Seismic STC LERF	1.363E-05	1.362E-05	0.07%
Combined STC LERF	**1.893E-05**	**1.712E-05**	**9.60%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.398E-07**	**0.00%**
SAMA NO-SGTR Unit 2 Model			
Int. Events CDF	2.405E-05	2.134E-05	11.27%
Int. Flood CDF	2.032E-06	2.032E-06	0.00%
High Winds CDF	1.901E-05	1.901E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.465E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.327E-04**	**1.300E-04**	**2.04%**
Int. Events STC LERF	4.776E-07	2.931E-07	38.63%
Int. Flood STC LERF	2.834E-08	2.082E-08	26.55%
High Winds STC LERF	3.220E-07	3.210E-07	0.31%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	2.801E-06	34.99%
Seismic STC LERF	1.363E-05	1.362E-05	0.07%
Combined STC LERF	**1.877E-05**	**1.706E-05**	**9.11%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	2.671E-08	2.671E-08	0.00%
Combined STC LLRF	**1.664E-07**	**1.664E-07**	**0.00%**
SAMA NO-SGTR Unit 3 Model			
Int. Events CDF	2.405E-05	2.134E-05	11.27%
Int. Flood CDF	1.900E-06	1.900E-06	0.00%
High Winds CDF	1.732E-05	1.732E-05	0.00%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 10 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.300E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.092E-04**	**1.065E-04**	**2.48%**
Int. Events STC LERF	4.776E-07	2.931E-07	38.63%
Int. Flood STC LERF	3.159E-08	1.911E-08	39.51%
High Winds STC LERF	2.922E-07	2.914E-07	0.27%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.013E-06	27.30%
Seismic STC LERF	1.363E-05	1.362E-05	0.07%
Combined STC LERF	**1.720E-05**	**1.624E-05**	**5.60%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	3.936E-08	3.936E-08	0.00%
Combined STC LLRF	**1.791E-07**	**1.791E-07**	**0.00%**
SAMA OPR Unit 1 Model			
Int. Events CDF	2.405E-05	2.370E-05	1.46%
Int. Flood CDF	1.583E-06	1.576E-06	0.46%
High Winds CDF	1.585E-05	1.583E-05	0.13%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.115E-05	0.41%
Seismic CDF	3.273E-05	2.989E-05	8.68%
Combined CDF	**1.258E-04**	**1.224E-04**	**2.72%**
Int. Events STC LERF	4.774E-07	4.694E-07	1.68%
Int. Flood STC LERF	1.585E-08	1.576E-08	0.58%
High Winds STC LERF	2.855E-07	2.854E-07	0.04%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.520E-06	0.10%
Seismic STC LERF	1.363E-05	1.313E-05	3.69%
Combined STC LERF	**1.893E-05**	**1.842E-05**	**2.72%**
Int. Events STC LLRF	1.397E-07	7.970E-08	42.95%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**7.985E-08**	**42.90%**
SAMA OPR Unit 2 Model			
Int. Events CDF	2.405E-05	2.370E-05	1.46%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 11 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Flood CDF	2.032E-06	1.998E-06	1.71%
High Winds CDF	1.901E-05	1.899E-05	0.11%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.449E-05	0.30%
Seismic CDF	3.273E-05	2.989E-05	8.68%
Combined CDF	**1.327E-04**	**1.293E-04**	**2.57%**
Int. Events STC LERF	4.776E-07	4.696E-07	1.68%
Int. Flood STC LERF	2.834E-08	2.796E-08	1.35%
High Winds STC LERF	3.220E-07	3.218E-07	0.06%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.306E-06	0.06%
Seismic STC LERF	1.363E-05	1.313E-05	3.69%
Combined STC LERF	**1.877E-05**	**1.825E-05**	**2.74%**
Int. Events STC LLRF	1.397E-07	7.970E-08	42.95%
Int. Flood STC LLRF	2.671E-08	2.615E-08	2.12%
Combined STC LLRF	**1.664E-07**	**1.058E-07**	**36.39%**
SAMA OPR Unit 3 Model			
Int. Events CDF	2.405E-05	2.370E-05	1.46%
Int. Flood CDF	1.900E-06	1.894E-06	0.34%
High Winds CDF	1.732E-05	1.730E-05	0.12%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.288E-05	0.36%
Seismic CDF	3.273E-05	2.989E-05	8.68%
Combined CDF	**1.092E-04**	**1.059E-04**	**3.05%**
Int. Events STC LERF	4.776E-07	4.696E-07	1.68%
Int. Flood STC LERF	3.159E-08	3.154E-08	0.17%
High Winds STC LERF	2.922E-07	2.920E-07	0.07%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.766E-06	0.10%
Seismic STC LERF	1.363E-05	1.313E-05	3.69%
Combined STC LERF	**1.720E-05**	**1.669E-05**	**2.99%**
Int. Events STC LLRF	1.397E-07	7.970E-08	42.95%
Int. Flood STC LLRF	3.936E-08	3.936E-08	0.00%
Combined STC LLRF	**1.791E-07**	**1.191E-07**	**33.51%**

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 12 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
SAMA RCP-SEAL Unit 1 Model			
Int. Events CDF	2.405E-05	2.171E-05	9.73%
Int. Flood CDF	1.583E-06	8.206E-07	48.17%
High Winds CDF	1.585E-05	1.495E-05	5.68%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	4.661E-05	9.24%
Seismic CDF	3.273E-05	3.096E-05	5.41%
Combined CDF	**1.258E-04**	**1.153E-04**	**8.36%**
Int. Events STC LERF	4.774E-07	4.540E-07	4.90%
Int. Flood STC LERF	1.585E-08	8.210E-09	48.20%
High Winds STC LERF	2.855E-07	2.764E-07	3.19%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	3.564E-06	21.23%
Seismic STC LERF	1.363E-05	1.323E-05	2.95%
Combined STC LERF	**1.893E-05**	**1.753E-05**	**7.41%**
Int. Events STC LLRF	1.397E-07	9.911E-08	29.06%
Int. Flood STC LLRF	1.476E-10	7.382E-11	50.00%
Combined STC LLRF	**1.398E-07**	**9.918E-08**	**29.08%**
SAMA RCP-SEAL Unit 2 Model			
Int. Events CDF	2.405E-05	2.172E-05	9.69%
Int. Flood CDF	2.032E-06	1.244E-06	38.77%
High Winds CDF	1.901E-05	1.818E-05	4.37%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	4.892E-05	10.49%
Seismic CDF	3.273E-05	3.096E-05	5.41%
Combined CDF	**1.327E-04**	**1.213E-04**	**8.63%**
Int. Events STC LERF	4.776E-07	4.542E-07	4.90%
Int. Flood STC LERF	2.834E-08	2.046E-08	27.80%
High Winds STC LERF	3.220E-07	3.135E-07	2.64%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	3.487E-06	19.07%
Seismic STC LERF	1.363E-05	1.323E-05	2.95%
Combined STC LERF	**1.877E-05**	**1.750E-05**	**6.73%**
Int. Events STC LLRF	1.397E-07	9.911E-08	29.06%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 13 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Flood STC LLRF	2.671E-08	1.982E-08	25.80%
Combined STC LLRF	**1.664E-07**	**1.189E-07**	**28.53%**
SAMA RCP-SEAL Unit 3 Model			
Int. Events CDF	2.405E-05	2.172E-05	9.69%
Int. Flood CDF	1.900E-06	1.074E-06	43.49%
High Winds CDF	1.732E-05	1.639E-05	5.37%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	2.939E-05	10.93%
Seismic CDF[1]	3.273E-05	3.096E-05	5.41%
Combined CDF	**1.092E-04**	**9.978E-05**	**8.66%**
Int. Events STC LERF	4.776E-07	4.542E-07	4.90%
Int. Flood STC LERF	3.159E-08	2.334E-08	26.13%
High Winds STC LERF	2.922E-07	2.824E-07	3.35%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.199E-06	20.61%
Seismic STC LERF	1.363E-05	1.323E-05	2.95%
Combined STC LERF	**1.720E-05**	**1.619E-05**	**5.89%**
Int. Events STC LLRF	1.397E-07	9.911E-08	29.06%
Int. Flood STC LLRF	3.936E-08	2.018E-08	48.74%
Combined STC LLRF	**1.791E-07**	**1.193E-07**	**33.38%**
SAMA RECIRC Unit 1 Model			
Int. Events CDF	2.405E-05	1.384E-05	42.45%
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.214E-05	23.41%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	4.684E-05	8.80%
Seismic CDF	3.273E-05	3.248E-05	0.75%
Combined CDF	**1.258E-04**	**1.071E-04**	**14.85%**
Int. Events STC LERF	4.774E-07	3.937E-07	17.53%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.462E-07	13.77%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.229E-06	6.54%
Seismic STC LERF	1.363E-05	1.360E-05	0.20%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 14 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Combined STC LERF	**1.893E-05**	**1.849E-05**	**2.36%**
Int. Events STC LLRF	1.397E-07	1.391E-07	0.43%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.392E-07**	**0.43%**
SAMA RECIRC Unit 2 Model			
Int. Events CDF	2.405E-05	1.384E-05	42.45%
Int. Flood CDF	2.032E-06	1.941E-06	4.49%
High Winds CDF	1.901E-05	1.523E-05	19.88%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.065E-05	7.32%
Seismic CDF	3.273E-05	3.248E-05	0.75%
Combined CDF	**1.327E-04**	**1.144E-04**	**13.81%**
Int. Events STC LERF	4.776E-07	3.940E-07	17.50%
Int. Flood STC LERF	2.834E-08	2.790E-08	1.55%
High Winds STC LERF	3.220E-07	2.850E-07	11.49%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	3.924E-06	8.92%
Seismic STC LERF	1.363E-05	1.360E-05	0.20%
Combined STC LERF	**1.877E-05**	**1.823E-05**	**2.84%**
Int. Events STC LLRF	1.397E-07	1.391E-07	0.43%
Int. Flood STC LLRF	2.671E-08	2.671E-08	0.00%
Combined STC LLRF	**1.664E-07**	**1.658E-07**	**0.36%**
SAMA RECIRC Unit 3 Model			
Int. Events CDF	2.405E-05	1.384E-05	42.45%
Int. Flood CDF	1.900E-06	1.839E-06	3.22%
High Winds CDF	1.732E-05	1.374E-05	20.67%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	2.959E-05	10.32%
Seismic CDF	3.273E-05	3.248E-05	0.75%
Combined CDF	**1.092E-04**	**9.174E-05**	**16.02%**
Int. Events STC LERF	4.776E-07	3.940E-07	17.50%
Int. Flood STC LERF	3.159E-08	3.094E-08	2.05%
High Winds STC LERF	2.922E-07	2.545E-07	12.90%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%

Table 4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 15 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Fire STC LERF	2.769E-06	2.607E-06	5.87%
Seismic STC LERF	1.363E-05	1.360E-05	0.20%
Combined STC LERF	**1.720E-05**	**1.689E-05**	**1.81%**
Int. Events STC LLRF	1.397E-07	1.391E-07	0.43%
Int. Flood STC LLRF	3.936E-08	3.897E-08	1.00%
Combined STC LLRF	**1.791E-07**	**1.781E-07**	**0.55%**
SAMA SFP Unit 1 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	1.583E-06	3.818E-07	75.88%
High Winds CDF	1.585E-05	1.585E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.136E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.258E-04**	**1.246E-04**	**0.95%**
Int. Events STC LERF	4.774E-07	4.774E-07	0.00%
Int. Flood STC LERF	1.585E-08	3.819E-09	75.90%
High Winds STC LERF	2.855E-07	2.855E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.525E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.893E-05**	**1.892E-05**	**0.06%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	1.476E-10	7.382E-11	50.00%
Combined STC LLRF	**1.398E-07**	**1.398E-07**	**0.05%**
SAMA SFP Unit 2 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	2.032E-06	8.085E-07	60.22%
High Winds CDF	1.901E-05	1.901E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.465E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.327E-04**	**1.315E-04**	**0.92%**
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	2.834E-08	1.609E-08	43.23%

4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 16 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
High Winds STC LERF	3.220E-07	3.220E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.308E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.877E-05**	**1.876E-05**	**0.07%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	2.671E-08	1.723E-08	35.51%
Combined STC LLRF	**1.664E-07**	**1.569E-07**	**5.70%**
SAMA SFP Unit 3 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	1.900E-06	6.461E-07	65.99%
High Winds CDF	1.732E-05	1.732E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.300E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.092E-04**	**1.080E-04**	**1.15%**
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	3.159E-08	1.903E-08	39.77%
High Winds STC LERF	2.922E-07	2.922E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.769E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.720E-05**	**1.719E-05**	**0.07%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	3.936E-08	2.221E-08	43.56%
Combined STC LLRF	**1.791E-07**	**1.619E-07**	**9.58%**
SAMA SPRAY Unit 1 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.585E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.136E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.258E-04**	**1.258E-04**	**0.00%**

4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 17 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Events STC LERF	4.774E-07	4.774E-07	0.00%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.855E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.525E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.893E-05**	**1.893E-05**	**0.00%**
Int. Events STC LLRF	1.397E-07	1.489E-07	-6.59%
Int. Flood STC LLRF	1.476E-10	1.409E-10	4.58%
Combined STC LLRF	**1.398E-07**	**1.490E-07**	**-6.57%**
SAMA SPRAY Unit 2 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	2.032E-06	2.032E-06	0.00%
High Winds CDF	1.901E-05	1.901E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.465E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	1.327E-04	1.327E-04	0.00%
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	2.834E-08	2.834E-08	0.00%
High Winds STC LERF	3.220E-07	3.220E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.308E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	1.877E-05	1.877E-05	0.00%
Int. Events STC LLRF	1.397E-07	1.489E-07	-6.59%
Int. Flood STC LLRF	2.671E-08	2.763E-08	-3.42%
Combined STC LLRF	1.664E-07	1.765E-07	-6.08%
SAMA SPRAY Unit 3 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	1.900E-06	1.900E-06	0.00%
High Winds CDF	1.732E-05	1.732E-05	0.00%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.300E-05	0.00%

4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 18 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	1.092E-04	1.092E-04	0.00%
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	3.159E-08	3.159E-08	0.00%
High Winds STC LERF	2.922E-07	2.922E-07	0.00%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.769E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	1.720E-05	1.720E-05	0.00%
Int. Events STC LLRF	1.397E-07	1.489E-07	-6.59%
Int. Flood STC LLRF	3.936E-08	4.091E-08	-3.94%
Combined STC LLRF	1.791E-07	1.898E-07	-6.00%
SAMA UST Unit 1 Model			
Int. Events CDF	2.405E-05	1.841E-05	23.45%
Int. Flood CDF	1.583E-06	1.546E-06	2.36%
High Winds CDF	1.585E-05	9.097E-06	42.61%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	3.879E-05	24.46%
Seismic CDF	3.273E-05	3.146E-05	3.88%
Combined CDF	**1.258E-04**	**9.955E-05**	**20.87%**
Int. Events STC LERF	4.774E-07	2.525E-07	47.11%
Int. Flood STC LERF	1.585E-08	1.548E-08	2.36%
High Winds STC LERF	2.855E-07	1.706E-07	40.25%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	2.820E-06	37.67%
Seismic STC LERF	1.363E-05	1.359E-05	0.33%
Combined STC LERF	**1.893E-05**	**1.684E-05**	**11.04%**
Int. Events STC LLRF	1.397E-07	1.132E-07	18.97%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.133E-07**	**18.95%**
SAMA UST Unit 2 Model			
Int. Events CDF	2.405E-05	1.841E-05	23.45%
Int. Flood CDF	2.032E-06	1.582E-06	22.15%
High Winds CDF	1.901E-05	1.186E-05	37.61%

4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 19 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	4.254E-05	22.17%
Seismic CDF	3.273E-05	3.146E-05	3.88%
Combined CDF	**1.327E-04**	**1.061E-04**	**20.06%**
Int. Events STC LERF	4.776E-07	2.525E-07	47.13%
Int. Flood STC LERF	2.834E-08	1.581E-08	44.20%
High Winds STC LERF	3.220E-07	2.014E-07	37.45%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	2.373E-06	44.92%
Seismic STC LERF	1.363E-05	1.359E-05	0.33%
Combined STC LERF	**1.877E-05**	**1.643E-05**	**12.47%**
Int. Events STC LLRF	1.397E-07	1.132E-07	18.97%
Int. Flood STC LLRF	2.671E-08	1.500E-08	43.85%
Combined STC LLRF	**1.664E-07**	**1.282E-07**	**22.96%**
SAMA UST Unit 3 Model			
Int. Events CDF	2.405E-05	1.841E-05	23.45%
Int. Flood CDF	1.900E-06	1.649E-06	13.21%
High Winds CDF	1.732E-05	1.027E-05	40.70%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	2.397E-05	27.37%
Seismic CDF	3.273E-05	3.146E-05	3.88%
Combined CDF	**1.092E-04**	**8.600E-05**	**21.27%**
Int. Events STC LERF	4.776E-07	2.525E-07	47.13%
Int. Flood STC LERF	3.159E-08	1.649E-08	47.80%
High Winds STC LERF	2.922E-07	1.720E-07	41.14%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	1.446E-06	47.77%
Seismic STC LERF	1.363E-05	1.359E-05	0.33%
Combined STC LERF	**1.720E-05**	**1.547E-05**	**10.05%**
Int. Events STC LLRF	1.397E-07	1.132E-07	18.97%
Int. Flood STC LLRF	3.936E-08	3.844E-08	2.34%
Combined STC LLRF	**1.791E-07**	**1.516E-07**	**15.31%**
SAMA WIND Unit 1 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%

4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 20 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
Int. Flood CDF	1.583E-06	1.583E-06	0.00%
High Winds CDF	1.585E-05	1.372E-05	13.44%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.136E-05	5.136E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.258E-04**	**1.237E-04**	**1.69%**
Int. Events STC LERF	4.774E-07	4.774E-07	0.00%
Int. Flood STC LERF	1.585E-08	1.585E-08	0.00%
High Winds STC LERF	2.855E-07	2.114E-07	25.95%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.525E-06	4.525E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.893E-05**	**1.886E-05**	**0.39%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	1.476E-10	1.476E-10	0.00%
Combined STC LLRF	**1.398E-07**	**1.398E-07**	**0.00%**
SAMA WIND Unit 2 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	2.032E-06	2.032E-06	0.00%
High Winds CDF	1.901E-05	1.478E-05	22.25%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	5.465E-05	5.465E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.327E-04**	**1.285E-04**	**3.19%**
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	2.834E-08	2.834E-08	0.00%
High Winds STC LERF	3.220E-07	2.236E-07	30.56%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	4.308E-06	4.308E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.877E-05**	**1.867E-05**	**0.52%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	2.671E-08	2.671E-08	0.00%
Combined STC LLRF	**1.664E-07**	**1.664E-07**	**0.00%**

4.15-2 Bounding Quantitative Reduction of CDF and Significant STC Group Frequencies (Sheet 21 of 21)

	Adjusted Base (/cy)	After SAMA (/cy)	Percent Reduction
SAMA WIND Unit 3 Model			
Int. Events CDF	2.405E-05	2.405E-05	0.00%
Int. Flood CDF	1.900E-06	1.900E-06	0.00%
High Winds CDF	1.732E-05	1.519E-05	12.30%
Ext. Flood CDF	2.465E-07	2.465E-07	0.00%
Fire CDF	3.300E-05	3.300E-05	0.00%
Seismic CDF	3.273E-05	3.273E-05	0.00%
Combined CDF	**1.092E-04**	**1.071E-04**	**1.95%**
Int. Events STC LERF	4.776E-07	4.776E-07	0.00%
Int. Flood STC LERF	3.159E-08	3.159E-08	0.00%
High Winds STC LERF	2.922E-07	2.307E-07	21.05%
Ext. Flood STC LERF	<1.0E-11	<1.0E-11	0.00%
Fire STC LERF	2.769E-06	2.769E-06	0.00%
Seismic STC LERF	1.363E-05	1.363E-05	0.00%
Combined STC LERF	**1.720E-05**	**1.714E-05**	**0.36%**
Int. Events STC LLRF	1.397E-07	1.397E-07	0.00%
Int. Flood STC LLRF	3.936E-08	3.936E-08	0.00%
Combined STC LLRF	**1.791E-07**	**1.791E-07**	**0.00%**

Note: HYD – This case was evaluated qualitatively and determined that the impact of SAMAs for hydrogen removal is insignificant.

5.0 NEW AND SIGNIFICANT INFORMATION

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)]

License renewal applicants are required to analyze only those issues the NRC has not resolved generically. While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)]

5.1 New and Significant Information Discussion

The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). In this guidance, new and significant information is defined as follows:

1) Information that identifies a significant environmental impact issue that was not considered or addressed in the GEIS and, consequently, not codified in Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants," in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)," of 10 CFR Part 51; or
2) Information not considered in the assessment of impacts evaluated in the GEIS leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
3) Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

Based on available guidance and the definitions of SMALL, MODERATE, and LARGE impacts provided by the NRC in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3, Duke Energy considers any new information regarding Category 1 issues with MODERATE or LARGE impacts would be significant. Section 4.0.2 presents the NRC's definitions of SMALL, MODERATE, and LARGE.

5.2 Duke Energy's New and Significant Information Review Process

The new and significant information assessment described below meets or addresses regulatory guidance provided above.

Duke Energy's process is collectively carried out through its ongoing environmental planning, assessment, monitoring, and compliance activities performed by corporate and ONS management and staff and ER-specific reviews. This team has collective knowledge of the license renewal process, the ONS site, licensing and permitting, environmental and regulatory issues, initial license renewals, the NEPA process, and other nuclear industry activities which could potentially provide new and significant information.

Duke Energy's new and significant information review included establishment of applicable and non-applicable Category 1 issues through:

- Review of the initial license renewal ER and the GEIS for its Category 1 discussions, and Supplement 2 to the GEIS;
- Identification and review of past or potential modifications to ONS, including environmental impacts; and
- Identification and assessment of equipment and operations with the potential to result in changes in emissions, releases, discharge points, land use, noise levels, etc., considering environmental reviews since initial license renewal, and those anticipated during the proposed license renewal term.

Duke Energy applied an investigative process for purposely seeking new information related to the Category 1 environmental issues through:

- Environmental review team discussions with Duke Energy and ONS subject matter experts on the Category 1 issues as they relate to the plant;
- Review of permits and reference materials related to environmental issues at the plant, the environmental resource areas related to Category 1 issues, and information collected for regulatory compliance status;
- Review of recent publicly available information, or information held by Duke Energy, particularly data or reports from the past five years, related to the resource area and each applicable Category 1 impact issue, as summarized in the appropriate section of the SLR ER in Chapter 3.0, Affected Environment;
- Consultation with state and federal resource agencies to determine if there are concerns pertinent to specific resource areas and ONS operations;
- Review of environmental monitoring and reporting required by regulations related to the ONS site and operations;
- Review of Duke Energy environmental programs and procedures related to the ONS site and operations;
- Review of correspondence and permitting documentation related to oversight of ONS facilities and operations by state and federal regulatory agencies (activities that would bring significant issues to the plant's attention), to identify site-specific environmental concerns; and

- Review of previous LRAs for issues relevant to this ONS Units 1, 2, and 3 SLR application.

In addition, Duke Energy is made aware of and stays abreast of new and emerging environmental issues and concerns on an ongoing basis through:

- Review of nuclear industry publications, operational experience, and participation in nuclear industry organizations;
- Routine interface with non-nuclear Duke Energy business units;
- Contact with federal, state, and local resource agencies with regulatory jurisdiction over environmental regulation; and
- Development and periodic review of regulatory guidance procedures that address ongoing and emergent issues.

Information resulting from the information-seeking process was assessed to determine if it is new and significant, applying the following considerations:

- Was the information included in or available for the GEIS analysis of the Category 1 issue?
- Was the information included in or available for the initial license renewal supplemental EIS for ONS?
- Does the information identify an environmental issue not generically considered in the GEIS, and consequently, not codified in 10 CFR 51 Appendix B Table B-1?
- Does the information present a seriously different picture of the environmental consequences of the action than previously considered, leading to an impact finding different from that included in the GEIS or codified in regulation?
- Does the information involve a new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity (MODERATE or LARGE) and/or scope (context) not previously recognized?

5.3 Duke Energy's New and Significant Information Review Results

As a result of this review, Duke Energy is aware of no new and significant information regarding the environmental impacts of SLR associated with ONS. The findings in NUREG-1437, Revision 1 for the applicable Category 1 issues are therefore incorporated by reference (see Table 4.0-2). New and significant information review methodology and results applicable to the issue of severe accidents, which is the functional equivalent of a Category 1 issue for ONS (NRC 2013e), are presented in the SAMA analysis in Section 4.15.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Chapter 5 incorporates by reference NRC findings for the 54 Category 1 issues that apply to ONS (plus the one uncategorized issue for which the NRC came to no generic conclusion), all of which have SMALL environmental impacts. Chapter 4 presents site-specific analyses of the 17 Category 2 issues. Table 6.1-1 identifies the environmental impacts that subsequent renewal of the ONS ROL would have on resources associated with Category 2 issues.

Duke Energy has reviewed the environmental impacts of subsequent renewal of the ONS ROLs and concluded that further mitigation measures beyond those presented in Section 6.2 and listed in Table 6.1-1 of this ER to avoid, reduce the severity of, or eliminate adverse impacts are not warranted. This ER documents the basis for Duke Energy's conclusion.

Table 6.1-1 Environmental Impacts Related to Subsequent License Renewal at ONS (Sheet 1 of 3)

Resource Issue	ER Section	Environmental Impact
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.1	No impact. Issue is not applicable because ONS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) [10 CFR 51.53(c)(3)(ii)(C)]	4.5.3	No impact. Issue is not applicable because ONS does not withdraw more than 100 gpm.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.2	No impact. Issue is not applicable because ONS utilizes a once-through cooling system and does not utilize a closed-cycle cooling system.
Groundwater quality degradation (plants with cooling ponds at inland sites) [10 CFR 51.53(c)(3)(ii)(D)]	4.5.4	No impact. Issue is not applicable because ONS uses a once through cooling system and does not utilize cooling ponds.
Radionuclides released to groundwater [10 CFR 51.53(c)(3)(ii)(P)]	4.5.5	SMALL impact. Water for station uses continues to be processed and monitored in compliance with licensing and permitting. Any impacts from radionuclides to groundwater do not warrant additional mitigation measures beyond compliance with the existing groundwater protection program.
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts) [10 CFR 51.53(c)(3)(ii)(E)]	4.6.5	SMALL impact. No refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls are in place to protect onsite important plant and animal habitats.
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.4	No impact. Issue is not applicable because ONS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.

Table 6.1-1 Environmental Impacts Related to Subsequent License Renewal at ONS (Sheet 2 of 3)

Resource Issue	ER Section	Environmental Impact
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.1	SMALL impact. Because the plant complies with the current NPDES permit, will comply with the future renewal of the permit, and will implement best available technology requirement to minimize impacts of impingement and entrainment, the impacts would be SMALL during the proposed SLR operating term.
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.2	SMALL impact. The thermal discharge associated with ONS outflow has been demonstrated to be protective of the Lake Keowee fishery and ONS is operating in conformance with its NPDES permit, and therefore in compliance with CWA requirements. Because there are no planned operational changes, impacts would be SMALL during the proposed SLR operating term.
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.3	No impact. Issue is not applicable because ONS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat [10 CFR 51.53(c)(3)(ii)(E)]	4.6.6	SMALL impact. No refurbishment or other license renewal-related construction activities have been identified. The continued operation of the site would have no adverse effects to any federally or state-listed species. EFH was not identified near ONS. Therefore, SLR would have no effect on threatened, endangered, and protected species, critical habitat, or EFH in the vicinity of ONS.

Table 6.1-1 Environmental Impacts Related to Subsequent License Renewal at ONS (Sheet 3 of 3)

Resource Issue	ER Section	Environmental Impact
Historic and Cultural Resources		
Historic and cultural resources [10 CFR 51.53(c)(3)(ii)(K)]	4.7	No adverse effects on historic properties. No refurbishment or other license renewal-related construction activities have been identified; administrative procedure ensures protection of these type of resources in the event of excavation activities.
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) [10 CFR 51.53(c)(3)(ii)(G)]	4.9.1	SMALL impact. Conditions necessary for optimal growth of pathogens are limited by water temperatures in the discharge area. The discharge area's location away from public access, along with ONS controls, also mitigates public exposure.
Electric shock hazards [10 CFR 51.53(c)(3)(ii)(H)]	4.9.2	SMALL impact. The NRC determined electric shock potential for the evaluated lines was small and did not warrant mitigation measures. All in-scope transmission lines are located completely within the ONS site and are NESC compliant.
Postulated Accidents		
Severe accidents [10 CFR 51.53(c)(3)(ii)(L)]	4.15	SMALL impact.
Environmental Justice		
Minority and low-income populations [10 CFR 51.53(c)(3)(ii)(N)]	4.10.1	No disproportionately high and adverse impacts or effects on minority and low-income populations identified.
Cumulative Impacts		
Cumulative Impacts [10 CFR 51.53(c)(3)(ii)(O)]	4.12	SMALL to no impacts are expected from the continued operation of ONS. SMALL for land use and visual resources, air quality and noise, geology and soils, socioeconomics, surface water, ground water, ecological resources, and waste management. No effect on aquatic resources, historic and cultural resources, and human health.

6.2 Mitigation

6.2.1 Requirements [10 CFR 51.45(c) and 10 CFR 51.53(c)(3)(iii)]

The environmental report must include an analysis that considers and balances . . . alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

6.2.2 Duke Energy Response

NRC Regulatory Guide 4.2, Supplement 1, Revision 1, *Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications*, specifies that the applicant should identify any ongoing mitigation and should address the potential need for additional mitigation. Applicants are only required to consider mitigation alternatives in proportion to the significance of the impact. (NRC 2013b)

As presented in Section 6.1, impacts associated with ONS SLR do not require the implementation of additional mitigation measures. The permits and programs presented in Chapter 9 (i.e., NPDES permit; stormwater program; air permit; SPCC plan; hazardous waste management program; cultural resource description process; and environmental review programs) that currently mitigate the operational environmental impacts of ONS are adequate. Therefore, additional mitigation measures are not sufficiently beneficial as to be warranted.

6.3 Unavoidable Adverse Impacts

6.3.1 Requirement [10 CFR 51.45(b)(2)]

The environmental report shall . . . discuss . . . any adverse environmental effects which cannot be avoided should the proposal be implemented . . . . [10 CFR 51.45(b)(2)]

6.3.2 Duke Energy Response

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit, because the facility is in existence at the license renewal stage and has operated for years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred.

As previously presented in Chapter 4 of this ER, Duke Energy does not anticipate the continued operations of ONS to adversely affect the environment. Duke Energy also does not anticipate any license renewal-related refurbishment as a result of the technical and aging management program information submitted in accordance with the NRC license renewal process. Therefore, the environmental impacts to be evaluated for SLR are those associated with continued operation during the renewal term.

Duke Energy adopts by reference NRC findings for the 54 Category 1 issues applicable to ONS, including discussions of any unavoidable adverse impacts (NRC 2013a). In addition, Duke Energy identified the following site-specific unavoidable adverse impacts associated with SLR:

- The majority of the land use at ONS would continue to be designated as industrial until the plant is shut down and decommissioned (decommissioning can take up to 60 years after permanent shutdown of ONS). Uranium mining associated with the nuclear fuel cycle also has offsite land use implications.
- Aquatic organisms would continue to be impinged at the CCW intake structure, but as presented in Section 4.6.1, these impacts were determined to be SMALL. Aquatic organisms would continue to be impacted by the thermal discharge associated with ONS outflow, but as presented in Section 4.6.2, the impacts comply with the NPDES permit and have been demonstrated to be protective of the Lake Keowee fishery.
- As discussed in Section 3.6.1.2.1, normal plant operations result in industrial wastewater discharges containing small amounts of water treatment chemical additives to the Lake Keowee and the Keowee River at or below SCDHEC approved concentrations. Compliance with the NPDES permit would ensure that impacts remain SMALL.
- As discussed in Section 2.2.3.5, plant operation of ONS results in consumptive water use of Lake Keowee. ONS uses a once-through cooling system that is permitted to withdraw 94,817 MGM and return 93,936 MGM (99 percent). During normal operation, most of the water withdrawn is returned to the lake. However, a small portion is lost to evaporation.
- Operation of ONS results in the generation of spent nuclear fuel and waste material, including LLRW, hazardous waste, and nonhazardous waste. Specific plant design features in conjunction with a waste minimization program, employee safety training programs and work procedures, and strict adherence to applicable regulations for storage, treatment, transportation, and ultimate disposal of this waste ensure that the impact is SMALL.
- Operation of ONS results in a very small increase in radioactivity in the air and water emissions. The incremental radiation dose to the local population resulting from ONS operations is typically less than the magnitude of the fluctuations that occur in natural background radiation. Doses to the public from ONS's gaseous releases would be well within the allowable limits of 10 CFR 20 and 10 CFR 50, Appendix I. Operation of ONS also creates a very low probability of accidental radiation exposure to inhabitants of the area. Other potential human health hazards are presented in Sections 4.9.1 and 4.9.2 which include electric shock hazards and microbial hazards. All in-scope transmission lines are located completely within the ONS site, are NESC compliant, and have training, maintenance, and surveillance procedures reducing the risk. Microbiological hazards are rare in the state but could occur near the ONS outflow. The depth and remote location of the ONS discharge reduce the risk to human health.

6.4 Irreversible or Irretrievable Resource Commitments

6.4.1 Requirement [10 CFR 51.45(b)(5)]

The environmental report shall . . . discuss . . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. [10 CFR 51.45(b)(5)]

6.4.2 Duke Energy Response

The term "irreversible" applies to the commitment of environmental resources (e.g., permanent use of land) that cannot by practical means be reversed to restore the environmental resources to their former state. In contrast, the term "irretrievable" applies to the commitment of material resources (e.g., irradiated steel, petroleum) that, once used, cannot by practical means be recycled or restored for other uses. The continued operation of ONS for the period of extended operation will result in irreversible and irretrievable resource commitments, including the following:

- Uranium in the nuclear fuel consumed in the reactor that becomes high-level radioactive waste if the used fuel is not recycled through reprocessing.
- Land required for permanent storage or disposal of spent nuclear fuel, LLRW generated as a result of plant operations, and sanitary waste generated from normal industrial operations.
- Elemental materials that will become radioactive.
- Materials used for the normal industrial operations of ONS that cannot be recovered or recycled, or that are consumed or reduced to unrecoverable forms.

Other than the above, no license renewal-related or refurbishment activities have been identified that would irreversibly or irretrievably commit significant environmental components of land, water, and air.

If ONS ceases operations on or before the expiration of the current ROLs, the likely power generation alternatives would require a commitment of resources for construction of the replacement plant as well as for fuel to run the plant. Significant resource commitments would also be required if transmission lines were needed to connect a replacement generation plant to the electrical grid.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

6.5.1 Requirement [10 CFR 51.45(b)(4)]

The environmental report shall . . . discuss . . . the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity . . . . [10 CFR 51.45(b)(4)]

6.5.2 Duke Energy Response

The current balance between short-term use and long-term productivity of the environment at the site has remained relatively constant since ONS began operations. The supplemental EIS for ONS evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of ONS (NRC 1999b, Section 9.1.3). The period of extended operation will not alter the short-term uses of the environment from the uses previously evaluated in the ONS final environmental statement (FES). The period of extended operation will postpone the availability of the site resources (land, air, water) for other uses. Denial of the application to renew the ONS ROLs would lead to the shutdown of the plant and would alter the balance in a manner that depends on the subsequent uses of the site. For example, the environmental consequences of turning the site area occupied by ONS into a park or an industrial facility after decommissioning are quite different. Extending ONS operations would not alter, but only postpone, the potential long-term uses of the site that are currently possible.

In summary, no license renewal-related refurbishment activities have been identified that would alter the evaluation of the ONS FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

The environmental report shall . . . discuss . . . alternatives to the proposed action . . . . [10 CFR 51.45(b)(3)]

The applicant shall discuss in this report the environmental impacts of alternatives and any other matters . . . . The report is not required to include discussion of need for power or economic costs and benefits of . . . alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation . . . . [10 CFR 51.53(c)(2)]

A reasonable alternative must be commercially viable on a utility scale and operational prior to the expiration of the reactor's operating license, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's operating license . . . . The amount of replacement power generated must equal the base-load capacity previously supplied by the nuclear plant and reliably operate at or near the nuclear plant's demonstrated capacity factor. (NRC 2013f, Section 2.3)

7.1 No Action Alternative

As described in Section 2.1, the proposed action is to renew for a second time, and for an additional 20-year period, the ROLs for ONS Units 1, 2, and 3. The only other alternative under consideration is the no-action alternative, which would be the decision *not* to renew the ONS ROLs. If the ROLs are not renewed, the 2,610 MWt per unit of baseload generation (Duke 2020a) would not be available to meet Duke Energy's power generation needs during the proposed SLR operating term from 2033–2053 for ONS Units 1 and 2 and from 2034–2054 for ONS Unit 3. Because Duke Energy is a regulated utility that must meet its customers' long-term power needs, the no-action alternative will identify replacement power sources for the loss of ONS generation.

In accordance with 10 CFR 51.53(b)(3), this ER will discuss a no-action alternative to the proposed license renewal and a range of alternatives for replacement baseload power sources. A reasonable alternative as described by the NRC must be technically feasible and commercially viable on a utility scale and operational prior to the expiration of the reactors' ROLs or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactors' ROLs (NRC 2013a). The replacement power alternative generation must also provide adequate baseload power capacity that was previously supplied by the nuclear plant.

The replacement power sources being considered under the no-action alternative are presented in Section 7.2.1. Section 7.2.2 will identify the no-action alternative power sources evaluated that were not considered reasonable power sources for the replacement of the ONS generation.

7.1.1 Decommissioning Impacts

The NRC's definition of decommissioning as stated in 10 CFR 20.1003 is the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits the following:

- Release of the property for unrestricted use and termination of the license; or
- Release of the property under restricted conditions and termination of the license.

The NRC-evaluated decommissioning options include the following:

- Immediate dismantling soon after the facility closes (DECON).
- Safe storage and monitoring of the facility for a period of time that allows the radioactivity to decay, followed by dismantling and additional decontamination (SAFSTOR).
- Permanent entombment on the site in structurally sound material such as concrete that is maintained and monitored (ENTOMB).

All the decommissioning options must be completed within a 60-year period following permanent cessation of operations and permanent removal of fuel.

Under the no-action alternative, Duke Energy would continue operating ONS until the existing ROLs expire. Upon expiration of the ROLs, Duke Energy would initiate decommissioning procedures in accordance with NRC requirements. The NRC GEIS evaluated decommissioning environmental impacts for land use, visual resources, air quality, noise, geology and soils, hydrology, ecology, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management and pollution prevention. Duke Energy considers the GEIS description of decommissioning impacts as representing the actions it would perform for the ONS decommissioning. Therefore, Duke Energy relies on the NRC's conclusions regarding the environmental impacts of decommissioning ONS.

Decommissioning and its associated impacts are not considered evaluation criteria used to proceed with the proposed action or select the no-action alternative. ONS will have to be decommissioned eventually, regardless of the NRC decision on license renewal and license renewal will only postpone decommissioning for another 20 years. The GEIS states the timing of the decommissioning does not change the environmental impacts associated with this activity. The NRC findings as described in 10 CFR 51, Subpart A, Appendix B, Table B-1 state that delaying decommissioning until after the renewal term would result in SMALL environmental impacts. Duke Energy relies on the NRC's findings.

The primary criteria used to evaluate the proposed action and the no-action alternative are the power options available for replacement of ONS generation. Duke Energy concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those following license renewal as identified in the GEIS. Decommissioning impacts would be SMALL and could overlap with operation of an ONS replacement.

7.2 Energy Alternatives that Meet System Generating Needs

In accordance with 10 CFR 51.53(c)(2), Duke Energy considered a range of alternatives to replace generation if the ONS ROLs are not renewed. The alternatives considered for replacement power were developed based on the following:

- Duke Energy considered each of the replacement alternatives identified in the NRC GEIS for license renewal (NRC 2013a, Section 2.3). These alternatives were evaluated based on their ability to provide reliable baseload power, as well as other criteria such as the ability to be operational prior to the expiration of the current ONS ROLs.

The following subsections will identify the power sources considered as reasonable (Section 7.2.1), and power sources considered as unreasonable (Section 7.2.2).

7.2.1 Energy Alternatives Considered as Reasonable

A reasonable alternative as described by the NRC must be technically feasible and commercially viable on a utility scale and operational prior to the expiration of the reactors' ROLs or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactors' ROLs. The replacement power alternative generation must also equal the baseload capacity previously supplied by the nuclear plant. The alternatives analysis identified the following power sources as meeting the NRC criteria for reasonableness in the replacement of ONS generation during the proposed SLR operating term.

- An NGCC plant sited at the ONS site and/or adjacent Duke Energy-owned property.
- A new advanced light water reactor (ALWR) nuclear facility, which would consist of the proposed W.S. Lee Nuclear Station, Units 1 & 2 and an SMR option sited at the ONS site.
- Alternative consisting of an NGCC unit sited at ONS and/or adjacent Duke Energy-owned property, two wind installations, five solar PV facilities sited at alternate sites with existing transmission, and DSM.

7.2.1.1 Natural Gas-Fired Generation

The NGCC plant option would be sited on approximately 130 acres of the existing ONS site and adjacent Duke Energy-owned property located across SC-183. This plant would consist of multiple combustion turbines, heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. Based on a capacity factor of 87 percent,

the replacement NGCC plant would be designed to generate approximately 3,009 MWe to replace the approximate estimated net generation for the three units inclusive of Duke's applied for MUR uprate (2,618 MWe) provided by ONS (EIA 2019a).

Duke Energy assumes that the plant would utilize mechanical draft cooling towers and, like ONS, the NGCC plant would utilize Lake Keowee for cooling water and discharge. The existing intake and discharge structures would be used, with some modifications and pump replacement as appropriate, for the NGCC plant. Duke Energy also assumed that the existing ONS transmission line infrastructure is adequate for the NGCC replacement alternative. The NGCC plant would require development of a natural gas pipeline to connect the plant to a natural gas supply. An existing natural gas pipeline terminates in Centerville, Anderson County, SC, approximately 21 miles from ONS.

7.2.1.2 New Nuclear

The new nuclear alternative involves two reactor types, an ALWR and an SMR, and two sites. The ALWR component is the proposed W.S. Lee Nuclear Station in Cherokee County, South Carolina. The SMR component is the development of an SMR facility, which includes a series of SMR units sited at the ONS site. The NRC issued a COL for W.S. Lee Nuclear Station effective December 19, 2016 (NRC 2016). The W.S. Lee Nuclear Station is projected to provide 1,117 MWe net per unit when in operation (NRC 2013f) for a total of 2,234 megawatts (MW). The remaining 384 MWe (net) would be supplied by the SMR facility at ONS, which would have a gross capacity of 427 MWe based on a 90 percent capacity factor (EIA 2019a, Table 1b) under this nuclear alternative. Duke Energy assumes that the plant would utilize mechanical draft cooling towers and, like ONS, the SMR plant would utilize Lake Keowee for cooling water and discharge. The existing intake and discharge structures would be used, with some modifications and pump replacement as appropriate, for the SMR plant. The existing transmission infrastructure is assumed to be sufficient.

7.2.1.3 Combination of Natural Gas-Fired Generation, Wind, and Solar

To assess the potential impacts, the combination alternative is proposed with an onsite NGCC plant, multiple offsite solar PV arrays supported by battery storage, two offsite wind installations, and additional DSM programs. The NGCC plant component would be a smaller plant than the one considered under the NGCC alternative (i.e., 2,749 MWe [gross], which yields approximately 2,392 MWe [net] after applying the 87 percent capacity factor). The solar PV component would be multiple offsite ground-mounted tracking solar arrays for a combined nameplate capacity of 350 MWe (i.e., five 70-MWe [gross] facilities), which based on a 29 percent capacity (EIA 2019a) would yield approximately 102 MWe. The solar facilities would be coupled with battery storage, allowing the intermittent solar generation to provide baseload 120 MWe (net). The solar arrays and battery storage facility are assumed to be located with connection to the existing power grid and no additional transmission infrastructure is assumed. Two wind installations of 90-MWe of nameplate capacity each would be located in central North Carolina or South Carolina and are assumed to be located with connection to the existing power grid and no additional transmission infrastructure is assumed. Duke Energy estimates the net

MWe for each 90-MWe wind installation to be 28 MWe (Duke 2020b).The DSM component of the combination alternative is considered to provide the equivalent 50 MWe of generation When combined, these facilities and programs would provide the 2,618 MWe (net) replacement power.

7.2.2 Energy Alternatives Not Considered Reasonable

The full range of energy alternatives as described in the GEIS include power sources that will require development of new generation and power alternatives that will not require new generation, such as purchased power (NRC 2013a, Section 2.3). Duke Energy considered all the alternatives described in the GEIS for replacement of the ONS generation. This section will address the energy alternatives that were not considered reasonable for additional evaluation.

7.2.2.1 Alternatives Not Requiring New Generating Capacity

7.2.2.1.1 Purchased Power

A mix of fossil generation, nuclear, and renewable generation would be a potential source of purchased power to replace ONS generation. Duke Energy currently purchases power from non-utility generation and wholesale power suppliers. The 2020 purchased power contracts annual MWe commitments totaled 2,146 MWe (winter commitment) in 2018 (Duke 2020b). To replace ONS generation would require Duke Energy to increase its purchased power more than 100 percent. Purchased power would require reliance of power generation outside of Duke Energy's control and would be subject to competing power demand to secure firm power contracts. Purchasing power from non-utility generators or power generators is not considered a reasonable no-action alternative because Duke Energy would need to substantially increase its purchased power, introducing uncertainties in energy reliability outside of Duke Energy's control.

Potential environmental impacts associated with purchased power could be substantial and exceed the impacts associated with the continued operation of ONS. Potential environmental impacts associated with purchased power would include those associated with the source of the generation and the transmission of the power into the Duke Energy service area. Fossil generation results in air emissions, water use and quality issues, and land use impacts associated with the plant footprint. Renewable energy generation, specifically solar and wind, have a large development footprint that can convert natural habitats to an industrial site. The conversion of forest and even agricultural lands to an industrial site can result in impacts to habitat that may adversely impact wildlife and plant species. Additional transmission capacity may be required to transport renewable or fossil generation into the region and this may result in impacts to communities and lands within and adjacent to the corridor. These impacts could include loss of sensitive habitat, visual and view shed impairment, and degradation of wetlands and stream crossings.

7.2.2.1.2 Plant Reactivation or Extended Service Life

The 2020 IRP considered retirement of all Duke Energy's coal-fired units to meet company carbon dioxide reduction goals which account for applicable state energy policy and legislation (Duke 2020b). Delaying retirement of coal-fired generation would result in the continued use of generation that has higher air emissions and it does not meet the goals identified in the 2020 IRP to reduce dependence on coal-fired generation (Duke 2020b). Therefore, plant reactivation and extended service life is not considered a reasonable alternative because of the environmental impacts associated with continued use of older generation sources.

7.2.2.1.3 Conservation or Demand-Side Management

DSM includes demand response that shifts electricity from a peak-use period to times of lower demand, and energy efficiency or conservation programs that reduce the amount of electricity required for existing activities and processes. A DSM alternative would be required to reduce the baseload demand in Duke Energy's service area by 2,618 MWe to be considered a reasonable alternative. Duke Energy has approved DSM programs in its South Carolina and North Carolina service areas. Considering the potential for energy efficiency programs to yield energy savings, Duke Energy developed a high energy efficiency program scenario that projected an additional energy savings of 424 MWe (Duke 2020b). This additional energy savings is less than 10 percent of the replacement power needed if the ONS ROLs were not renewed. Therefore, DSM is not considered a reasonable alternative by itself, but can be a component of a combination of alternatives.

7.2.2.2 Alternatives Requiring New Generation Capacity

7.2.2.2.1 Wind (Included Energy Storage)

Onshore wind resources are limited in the eastern portion of the United States to select sites, such as mountain ridges in the Appalachian Mountains. Offshore wind potential has been explored in North Carolina. In 2015, the U.S. Bureau of Ocean Energy Management (BOEM) completed environmental assessments at three potential outer continental shelf sites off the coast of North Carolina. In March 2017, BOEM administered a competitive lease auction for wind energy in federal waters in three wind energy areas off the coast of North Carolina. BOEM awarded Avangrid Renewables the rights to develop the largest of the three areas, the Kitty Hawk wind energy area. Avangrid has plans for a project that may be as large as 1,500 MWe. In 2020, offshore wind energy is becoming a more viable alternative, but the only project near the Carolinas with the necessary BOEM offshore lease to begin construction is the Avangrid Kitty Hawk (Duke 2020b)

Installation and siting require careful consideration to bathymetry and offshore construction concerns. Siting is further complicated by shipping lanes, fishing rights, wildlife migration patterns, military operations, and other environmental concerns. Wind installations also pose aesthetic impact concerns, so the larger turbines require longer offshore distances to minimize aesthetic impacts. Environmental impacts associated with the construction and operation of a

large utility-scale offshore wind facility could range from MODERATE to LARGE and would require multiple installations.

For wind power to be viable as a discrete source of large amounts of energy that is reliably available at the system peak hours, energy storage would need to be considered in the planning process. No utility-scale energy storage facilities other than pumped storage hydropower currently exist in the Duke Energy service area (Duke 2020b), and development of new energy storage facilities would need to address additional environmental impacts. Therefore, energy storage is not considered in this ER as a technology that would make discrete wind energy facilities a reliable source of generation.

Because of the limited onshore wind resources in the eastern United States, potentially large environmental impacts associated with development of an offshore facility, and the inability of wind power to provide baseload generation, wind power (with or without energy storage) is not considered a reasonable alternative to replace the baseload generation of ONS.

Nonetheless, even if wind were considered to be reasonable, the impacts discussed above show that the impacts from wind (with or without energy storage) would be higher than the impacts for renewal of the ONS ROLs, as summarized in Table 8.0-1. Therefore, wind alone (with or without energy storage) would not be superior to continued operation of ONS.

7.2.2.2.2 Solar (Includes Energy Storage)

Solar PV and concentrated solar power (CSP) are the two main types of solar technology used in electric power generation. Solar PV systems consist of interconnected PV cells that convert sunlight into electricity. CSP systems utilize mirrors to reflect and concentrate sunlight onto receivers to convert solar energy into thermal energy that in turn produces electricity. Solar generation is intermittent by nature, and generation can fluctuate from hour to hour. This type of generation volatility on a large scale can create distribution and/or transmission instability.

Due to the amount of solar generating capacity needed to replace the entire ONS baseload generation and the lower efficiencies in producing electricity from solar power versus nuclear power, the land acreage required to install solar generation is larger than other alternatives being considered in this ER. Therefore, depending on the location of the solar facilities, the land use disturbances could result in moderate to large impacts on wildlife habitats, vegetation, land use, and aesthetics.

For solar power to be viable as a discrete source of large amounts of energy that is reliably available at the system peak hours, energy storage would need to be considered in the planning process. Current energy storage technologies are costly, and no utility-scale energy storage facilities currently exist in the Duke Energy service area other than pumped storage hydropower (Duke 2020b). Development of new energy storage facilities would need to address additional environmental impacts. Therefore, energy storage is not considered in this ER as a technology that would make discrete solar energy facilities a reliable source of generation.

Because a discrete solar generation alternative is not a source of large amounts of energy that is reliably available at the system peak hours, and because of the potential environmental impacts associated with the large land disturbances for this scale of solar power installation, this alternative, by itself or with energy storage, is not considered a reasonable alternative to replace the baseload generation of ONS.

Nonetheless, even if solar were considered to be reasonable, the impacts discussed above show that the impacts from solar (with or without energy storage) would be higher than the impacts for renewal of the ONS ROLs, as summarized in Table 8.0-1. Therefore, solar alone (with or without energy storage) would not be superior to continued operation of ONS.

7.2.2.2.3 Hydropower

Duke Energy has a pumped storage hydro capacity of 2,140 MWe and 1,078.8 MWe hydropower generation capacity in the states of North Carolina and South Carolina (Duke 2020b). Duke Energy plans to uprate its existing four hydropower units at its Bad Creek pumped storage facility located in South Carolina upstream of Lake Keowee by 65 MWe each (260 MWe total) (Duke 2020b).

The U.S. Department of Energy's Oak Ridge National Laboratory assessed the ability of existing non-powered dams across the country to generate electricity. The non-powered dams in North Carolina and South Carolina do not provide the scale of power generation capacity needed to replace ONS's generation capacity (ORNL 2012). The study assessed the dam with the greatest generation potential to be approximately 24 MWe.

Construction of a new large-scale hydropower facility would require considerable siting considerations, such as the area that would be inundated to provide water storage for generation, as well as the overall environmental impacts associated with the development of the facility. The environmental impacts would be large for land use, water resources, socioeconomics, ecology, and cultural resources.

The lack of potential for large hydroelectric power facilities at existing dams in the Duke Energy service area and the environmental constraints associated with the development of a new hydropower facility make hydropower an unreasonable alternative to replace the ONS generation.

7.2.2.2.4 Geothermal

The National Renewable Energy Laboratory has not identified any viable sites for geothermal energy in the eastern United States (NREL 2009). Therefore, geothermal energy is not considered a reasonable power source in the Duke Energy service area.

7.2.2.2.5 Biomass

Biomass includes wood waste, municipal waste, manure, certain crops, and other types of waste residues used to create electricity. Using biomass-fired generation for baseload power

depends on the geographic distribution, available quantities, constancy of supply, and energy content of biomass resources. For its 2018 resource planning, Duke Energy considered small-scale biomass generation, including a 5-MWe landfill gas facility and a 75-MWe wood bubbling fluidized bed facility. Neither generation source was selected for further study based on regulatory considerations, including environmental, reliability, and economic. Duke Energy also pursued poultry and swine waste projects through third-party proposals. These biomass generation options were considered less in the 2020 IRP plan (Duke 2020b).

Biomass plants tend to be much smaller than nuclear or fossil fuel plants. To replace the ONS baseload generation, it would take the construction of several biomass plants located near reliable fuel sources that continuously produce enough biomass to fuel the plants. Large biomass plants are generally 50 MWe, with the largest ones being slightly more than 100 MWe (NRC 2019b). Replacing the generating capacity of ONS using only biomass would require the construction of more than 25 large facilities.

Biomass plants require storage facilities for the fuel products and for waste ash/residue for the wood, crop, and agriculture waste types. Wood waste plants require a large land area for storage and processing, and, like coal generation, they produce ash that must be disposed of in a manner that does not pollute waterways and air. Therefore, environmental impacts associated with construction of a wood waste plant would be MODERATE to LARGE, with the impact intensity level being dependent on the siting and proximity to a source of wood waste.

Utilizing municipal solid waste for electricity is also dependent on being close to large population centers that generate large amounts of waste. Air emissions are also an issue with biomass plants, and construction of a plant would require installation of maximum achievable control technology to comply with the CAA. The combustion of the fuel also results in air emissions that must be controlled to meet air quality regulations.

Overall, the construction and operation of a biomass plant of the size necessary to act as an alternative to ONS would result in MODERATE environmental impacts to land use, water quality, ecological resources, and air quality.

Generating baseload generation from biomass sources is limited because of the need to site facilities near substantial fuel sources and impacts to land from constructing and operating the facility. In addition, without the construction of multiple smaller facilities, biomass plants are unable to produce the large baseloads of electricity that nuclear and fossil fuel plants generate. Therefore, biomass is not considered a reasonable alternative to ONS's baseload generation.

7.2.2.2.6 Fuel Cells

Fuel cells have entered the power generation marketplace and in 2019 Duke Energy acquired a portfolio of distributed fuel cell technology projects from Bloom Energy Corporation (Duke 2019d). The Bloom energy fuel cells are designed to be clustered to scale the generation capacity to meet individual customer needs. Current fuel cell installations provide from hundreds of kilowatts to tens of megawatts of power, which is a significantly smaller scale than what is

needed as a reasonable replacement of ONS's generating capacity. Fuel cells as a utility-scale generation alternative are not presently economically or technologically competitive with other alternatives. The U.S. Energy Information Administration projects that fuel cells may cost $7,197 per installed kW (total overnight capital costs), which is higher than most generation technologies analyzed in this ER (EIA 2019b). Therefore, fuel cells are not considered a reasonable alternative to ONS's baseload generation.

7.2.2.2.7 Ocean Wave and Current Energy

The technology to harness hydrokinetic energy is in development with many demonstration projects deployed around the world (DOE 2019). The FERC has licensing authority over hydrokinetic energy projects deployed in the United States. Currently, there are three licensed pilot projects and four projects seeking permits or holding a preliminary permit. The largest project is a 20-MWe marine project. The largest inland project is a 6-MWe project proposed for the Mississippi River. (83 FR 11192; FERC 2019).

Given hydrokinetic technology is in the early stages of commercial application and projects have low generation capacities, ocean wave and current energy is not considered a reasonable alternative in the necessary time frame for power supply.

7.2.2.2.8 Oil

Oil-fired generation does not fit into Duke Energy's sustainability goals to reduce carbon emissions from its North Carolina and South Carolina assets by more than at least 50 percent from 2005 levels by 2030 (Duke 2020b). Oil-fired generation emits large amounts of carbon dioxide and hazardous air pollutants, making it undesirable for utilities looking to reduce air pollutants and comply with regulations. Based on the greater environmental impacts and cleaner energy source policies and regulations, oil-fired generation is not a reasonable alternative.

7.2.2.2.9 Coal-fired

Coal-fired generation does not fit into Duke Energy's sustainability goals to reduce carbon emissions from its North Carolina and South Carolina assets by more than 50 percent from 2005 levels by 2030 (Duke 2020b). Coal-fired generation emits large amounts of carbon dioxide and hazardous air pollutants, making it undesirable for utilities looking to reduce air pollutants and comply with regulations. Based on the greater environmental impacts and cleaner energy source policies and regulations, coal-fired generation is not a reasonable alternative.

The NRC recently considered a supercritical pulverized coal facility as an alternative to renewing the River Bend Station Unit 1 OL, finding license renewal the preferred alternative. The supercritical pulverized coal facility alternative had operating impacts greater than license renewal, in addition to the environmental impacts inherent with new construction projects. (NRC 2018)

Based on the greater potential environmental impacts and limited technical viability, coal-fired generation is not a reasonable alternative.

7.2.3 Environmental Impacts of Alternatives

7.2.3.1 Natural Gas-Fired Generation

As identified in Section 7.2.1, an NGCC plant is considered a reasonable power alternative. This plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator. Based on a capacity factor of 87 percent (EIA 2019a), the NGCC plant would have a design capacity of 3,009 MWe (gross) of generation.

7.2.3.1.1 Land Use

The NGCC plant would require approximately 130 acres based on a land use factor of 0.02 square meters per megawatt hour (NETL 2010a) and the acreage used by the typical U.S. NGCC plant (Leidos 2016). The ONS site offers open space and existing material staging areas that could be used to develop the NGCC plant. About 70 acres are available south of the 525-kV switchyard and an additional 30 acres are available east of this switchyard. The additional acreage needed for an NGCC plant could be gained from demolition of existing ONS structures or using existing ONS structures for the NGCC plant that are not necessary for the operation of Units 1, 2, and 3. As an alternative, the additional required acreage (approximately 30 acres) could be supplied from adjacent Duke Energy-owned property located across SC-183. NGCC facilities, particularly support facilities that do not require cooling and transmission infrastructure, could be sited on this offsite property. This offsite property (totaling approximately 450 acres) across from the ONS site and along SC-183 was studied as a portion of the alternative Keowee site in the W.S. Lee Nuclear Station combined license final EIS. There are cleared and developed areas on this property; however, most of the property is maintained by Duke Energy as forested land. The continued use of the ONS site for energy generation and the conversion of adjacent forested land for construction of the NGCC alternative would have a SMALL land use impact.

It is assumed that the NGCC plant natural gas pipeline would be installed in a new corridor. The closest natural gas pipeline is approximately 21 miles from ONS at Centerville, SC (USDOT 2019b). This is a spur off the transcontinental pipeline (Transco), that transverses the northwestern corner of South Carolina (USDOT 2019b; SC Energy 2016). The Transco pipeline is approximately 28 miles from ONS. The development of a new pipeline corridor could change the land use for the area depending on the selected corridor, and would require a managed vegetation community devoid of woody vegetation.

In addition to onsite land requirements, offsite land is typically required for natural gas wells and related infrastructure. A new pipeline corridor approximately 75 feet wide for the 21 miles from Centerville to ONS would require approximately 191 acres. No new gas wells are assumed to be needed, because there is currently an abundant supply of natural gas in the United States. EIA reported a supplemental gas supply of more than 61 million cubic feet in 2019 (EIA 2020).

Therefore, Duke Energy assumes the current and proposed regional natural gas supply will be sufficient for the NGCC plant at ONS.

Construction-related impacts to land use would be SMALL from ONS because the plant would wholly or primarily use land already in use for energy production. The impact to land use from installation of the pipeline would be MODERATE from the potential reclassification of acreage within the region for the new corridor and its maintenance as a permanent corridor.

No changes to land use would occur from operation of the NGCC plant alternative. The land use impacts associated with the operation of the NGCC plant would be SMALL.

7.2.3.1.2 Visual Resources

During the construction phase of the project, the NGCC plant site would require some tree removal and land clearing and some demolition of existing structures and laydown areas. Construction activities would be visible from SC-183. Because the site currently has an existing power plant, the ongoing construction activity associated with the NGCC plant would be similar in scope to the existing industrial character of the site. Any offsite acreage used would be located adjacent to the plant, so the development would be an extension of the industrial character. Visual impacts during construction under the NGCC plant alternative would be SMALL.

During operations, the tallest structures at an NGCC plant alternative would be the exhaust stacks. The facility would be visible from SC-183 but not out of context with the developed site and the existing ONS facility. Overall, the addition of an NGCC plant will not significantly alter the viewshed at the ONS site. Visual impacts associated with the operation of an NGCC plant would be SMALL.

It is assumed that the NGCC plant natural gas pipeline corridor would be installed in a new pipeline corridor. Construction activities would result in temporary and localized visual impacts. New corridors would also incur visual impacts from clearing the land, especially forested lands that would be converted to cleared right-of-way after installation of the pipeline. However, new corridors would undergo a selection process that includes avoidance of sensitive areas such as scenic areas, sensitive wildlife habitats, and cultural sites that could result in greater visual impacts. The impact to visual resources from installation of the pipeline would be SMALL.

7.2.3.1.3 Air Quality

Air quality impacts associated with the construction of a NGCC plant would result in the emissions of various criteria pollutants such as CO, NO_x, sulfur oxides (SO_x) PM, and volatile organic compounds (VOCs). These criteria pollutants would be released from the use of construction vehicles and equipment. VOC releases would also result from the onsite storage and dispensing of vehicle and equipment fuels. Some GHGs would also be emitted from the use of construction equipment and vehicles during the construction of the plant. Onsite activities such as clearing and grubbing would also result in fugitive dust. The air quality impacts

associated with the construction of the NGCC plant alternative would be short-term, as gas-fired power plants are generally constructed in two to three years. The air impacts during construction would be minimized by the implementation of a fugitive dust control plan and adherence to best management practices such as the idling of vehicles and construction equipment. Therefore, the construction-related impacts on air quality under the NGCC plant alternative would be SMALL.

The operational NGCC plant would be equipped with air pollution controls to ensure compliance with air quality regulations. Emission estimates for the NGCC plant based on EPA AP-42 emission factors are shown in Table 7.2-1. Table 7.2-2 compares estimated emissions based on the EPA AP-42 factors with emissions based on estimates by Duke Energy for its new NGCC plant in Citrus County, Florida.

The NGCC plant would qualify as a new major source of criteria pollutants and would be subject to the CAA prevention of significant deterioration air quality review. Therefore, the plant would have to comply with the new source performance standard for NGCC plants set forth in 40 CFR 60 Subpart KKKK and 40 CFR 60 Subpart TTTT. The plant would also qualify as a major source because of its potential to emit greater than 100 tons per year of criteria pollutants. The plant would be required to obtain a Title V operating permit.

The NGCC plant would be subject to the national emission standards for hazardous air pollutants (HAPs) for stationary combustion turbines if the plant was a major source of HAPs (having the potential to emit 10 tons per year of more of any single HAP or 25 tons per year or more of any combination of HAPs) [40 CFR 63.6085(b)].

The mechanical draft cooling towers, which would be located onsite, would also have air emissions and atmospheric effects from drift and plumes. Cooling tower drift consists of the liquid droplets entrained in the exhaust air stream. A plume forms when the saturated water vapor leaving the top of the tower encounters cooler air and very small water droplets condense out of the air. Drift that leaves the top of the tower will reflect the same water chemistry as that of the circulating water. The water chemistry would be controlled by Duke Energy and would be in accordance with the restrictions defined in the plant's NPDES permit for use of water treatment chemicals and discharge limits.

When the small droplets within the drift or plumes are released into the air, evaporation occurs, leaving behind the solids that were once dissolved. This has the effect of introducing fine particulate matter into the atmosphere. Particulate matter emissions (e.g., PM_{10} and $PM_{2.5}$) are regulated air emissions. The dissolved solids from both drift and plumes could also be deposited on the surrounding land. If the deposited solids have levels of salt that could have impacts on vegetation, the deposition would be expected to be localized primarily onsite and on the surrounding Duke Energy-owned land. Therefore, potential offsite impacts, if any, would be small. Atmospheric effects of plumes could include icing, fogging, and shadowing. The mild winters of the ONS area would reduce the potential for icing and fogging. The impacts due to

shadowing, also known as the reduction of sunlight on cultivated fields, are not expected due to the surrounding land use being primarily residential (see Section 4.12).

A new NGCC plant would also have to comply with Title IV of CAA [42 USC 7651] reduction requirements for SO_2 and NO_x, which are the main precursors of acid rain and the major causes of reduced visibility.

A new NGCC plant would be a major source of criteria pollutants and GHGs. Compliance with existing air quality regulations would ensure air quality impacts are minimized. Therefore, the operations-related impacts on air quality under the NGCC plant alternative would be MODERATE.

7.2.3.1.4 Noise

Construction-related noise impacts would include the operation of vehicles, earthmoving equipment, and other equipment such as generators and compressors used in the construction of the facility. The NGCC plant alternative would be located on and adjacent to the existing ONS site (an industrial site), and a state road. Most of the area's residences are along Lake Keowee in Oconee County, north of ONS. The NGCC site would be located on the south side of the ONS property. A NRHP site and historic cemetery east of ONS along SC-183 (see Section 3.8) would be the closest site with sensitive receptors and occasional visitors. These sites do not have permanent staff and visitors are anticipated to be at the NRHP site and cemetery on a short-term basis. Noise from construction of the associated pipeline is expected to be of a short duration, in the range of a few weeks at any one location along the corridor as the pipeline installation progresses. Therefore, construction-related noise impacts would be SMALL.

Noise impacts associated with plant operations would include noise from transformers, turbines, pumps, compressors, exhaust stack, combustion inlet filter house, condenser fans, the mechanical draft cooling towers, and high-pressure steam piping. Noise from a cooling tower generally consists of sounds created by the motors, the speed reduction or power transmission units, the fans, and the cascading water, all of which combine to produce a typical sound level of 70 dBA at a horizontal distance of 1,000 feet (NRC 2019i). The cooling towers would be located near the center of the ONS site and the sound would be attenuated by the surrounding buildings and distance to the site border. The nearest residence is located approximately 1.03 miles north-northwest from the center point of the Unit 2 reactor containment (see Section 3.1.2). Given sound attenuation and distance to the nearest residence, noise impacts from the NCGG plant to sensitive receptors are not expected. No noise impacts would occur from operation of the pipeline beyond intermittent maintenance activities. Therefore, operations-related noise impacts associated with the NGCC plant would be SMALL.

7.2.3.1.5 Geology and Soils

Construction-related impacts to geology would be minimal as the excavation associated with plant installation should not damage geologic formations at the site. In addition, materials such as stone and gravel used in the construction of the plant and associated infrastructure would be

obtained from local or regional sources. Commercial stone and gravel sources typically sell material obtained from local quarries and other sources. Therefore, construction-related impacts to geology would be SMALL.

Construction-related impacts to soil would occur during land clearing and filling and the construction of the plant. Duke Energy assumes that the NGCC plant would be constructed on the ONS site on land ranging from developed land use, open spaces, and land with trees that will require clearing. In addition, if acreage across SC-183 is used, this property would require clearing and filling. Installation of a new natural gas pipeline to transport fuel to the site would disturb soil temporarily until installation of the pipeline is complete. The exposure of soils during clearing and grubbing will increase the risk of erosion from precipitation and high wind events. Soils excavated and removed during clearing and construction would be stockpiled onsite for use as backfill after construction is completed. Because the ground disturbance would exceed one acre, Duke Energy would obtain a stormwater construction general permit from SCDHEC. This is a general permit for construction activities that require installation of BMPs to minimize erosion and sediment loss resulting from precipitation. Overall, with the installation and implementation of BMPs, construction-related impacts to soils would be SMALL.

Land disturbance activities initiated during the operation of the NGCC plant would comply with applicable SCDHEC regulations for stormwater permitting. The ONS SWPPP would be modified to address the potential NGCC plant, identifying proper BMPs to minimize sediment releases. Soil impacts related to the operation of the plant would be SMALL. No geological impacts are expected during the operation of the plant.

7.2.3.1.6 Hydrology (Surface Water and Groundwater)

Surface Water

The construction-related impacts to surface water include those related to construction of the plant and infrastructure that would alter surface drainage features. The clearing of vegetation on the ONS site may also alter drainage features that convey runoff onsite. If acreage across SC-183 is also used for portions of the plant, clearing and filling would be required. As discussed in Section 7.2.3.1.1, the acreage needed is approximately 130 acres, with approximately 100 acres available onsite, much of which was previously developed for laydown areas and the firing range. Some clearing and tree removal would be needed. The remainder of acreage needed, approximately 30 acres, could come from demolition of structures onsite or from the adjacent Duke Energy-owned property across SC-183.

The impacts from drainage alterations would be minimized by the implementation of BMPs identified in the stormwater construction general permit SWPPP. Adherence to the BMPs and use of existing ONS drainage features, such as CTP-3, would also minimize stormwater runoff from the construction site, which would minimize sediment release and provide protection to Lake Keowee from accidental releases of oils or other chemicals being used during the construction of the facility. Any construction activities across SC-183 would have to be covered

by a stormwater permit and SWPPP as well, either as part of the ONS site permit and SWPPP or separately.

Duke Energy assumes the ONS intake and discharge structures will be used, with some modification, for the NGCC plant alternative. Closed-cycle cooling for the NGCC plant alternative would result in water consumption losses from Lake Keowee. Closed-cycle cooling for the NGCC plant alternative would result in water consumption due to evaporation and drift. A new NPDES permit or modifications to the existing permit would be required for the NGCC plant discharge.

Overall, the NGCC plant construction-related impacts on surface water and water quality would be SMALL.

A new natural gas pipeline would be required to provide fuel for the NGCC plant alternative. It is assumed that this pipeline would be installed in a new utility corridor. The pipeline would cross streams, rivers, and potentially wetlands that may require permitting. Stream, river, and wetland impacts would be minimized by avoidance and installing the pipeline under these features via horizontal directional drilling. For installation near streams and stream crossing, USACE Section 404 permitting could be required. This permit would identify BMPs and other mitigation to minimize impacts to waterways and wetlands. Typically, pipeline installation impacts to streams and rivers are temporary in duration. Through compliance with permit conditions and implementation of BMPs, surface water impacts from NGCC plant construction and installation of a new natural gas pipeline would be SMALL.

Operating the NGCC plant would require water to be obtained from Lake Keowee for cooling. The NGCC plant would have water withdrawals of approximately 11 MGD and consume approximately 9.4 MGD based on the water use factors developed by the National Energy Technology Laboratory (NETL) of 0.15 gallons per kilowatt hour (gal/kWh) for withdrawals and 0.13 gal/kWh for consumption (NETL 2010b, Appendix D). Duke Energy's operating experience with NGCCs indicates that the NGCC would consume about a third of this estimate based on NETL's factor. As presented in Section 3.6.3, ONS averaged a withdrawal rate of 54,495.61 MGD between 2014 and 2018. Nearly all of this withdrawal would have been returned; however, assuming a 0.4 percent consumption rate (NETL 2010b), ONS's consumption would be more than 200 MGD. The closed-cycle cooling system would require the use of water treatment chemicals to prevent scaling and bio-fouling. The water treatment chemicals and the discharge would be subject to the plant's NPDES permit, which is designed to protect water quality. Surface water impacts from operating the NGCC plant would be SMALL.

Groundwater

Duke Energy assumes water used for construction purposes such as dust suppression, equipment washing, sanitary systems, and potable water would be obtained through municipal supply. Excavations for facility foundations may also intrude into groundwater zones, but measures such as slurry walls and grouting are readily available to control water inflow to the excavation if needed. Therefore, because there would be no groundwater use and the impact of

dewatering would be temporary and minor, impacts from groundwater use are not expected. Construction-related impacts to groundwater could also occur from spills which are not properly mitigated and thereby transport contaminants through the soil to the groundwater. Construction-related impacts to groundwater can be mitigated by adhering to the BMPs in the SWPPP. Therefore, construction-related impacts on groundwater use and quality under the NGCC plant alternative would be SMALL.

Operations-related impacts under the NGCC plant alternative would be minor and mitigated through use of BMPs that collect stormwater from the industrial site. In addition, waste management and spill mitigation would minimize the spread of contaminants through the soil into the groundwater. Therefore, operations-related impacts on groundwater use and quality under the NGCC plant alternative would be SMALL.

7.2.3.1.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial

Terrestrial ecology impacts resulting from the construction of the NGCC plant would primarily result from development at the ONS site (approximately 100 acres) and adjacent land (approximately 30 acres) from land clearing, noise, and emissions of construction activities. As described in Section 7.2.3.1.1, the area proposed for construction is a mix of cleared, developed, and forested land uses. The clearing of vegetation and tree removal would displace wildlife that would disperse to adjacent undisturbed habitats. The area across SC-183 would have the greater potential of displacing wildlife because it includes previously undisturbed habitat.

In the W.S. Lee Nuclear Station EIS, the NRC reviewed the potential impacts of constructing two nuclear units on terrestrial ecological resources at the Keowee site, which included approximately 450 acres across SC-183 and adjacent ONS. This land area includes the approximately 30 acres being considered for the ONS NGCC alternative. The 2009 land cover types at the Keowee site were: mixed hardwood (212 acres), pine (122 acres), mixed hardwood/pine (46 acres), pine/mixed hardwood (39 acres), open water (18 acres), and open/field/meadow (13 acres). The NRC determined the preconstruction and construction activities at the Keowee site, along with impacts at corridors and a reservoir site of approximately 1,000 acres, would result in MODERATE impacts. (NRC 2013f, Section 9.3.4.3) The NGCC alternative considered for this analysis would only disturb a fraction of the land area considered for the Keowee site and could avoid the higher-quality wildlife habitat of hardwood and mixed hardwood forest.

Based on implementation of construction BMPs for erosion and dust control, noise abatement, proper equipment maintenance, restricting the timing of activities to minimize impacts during nesting/roosting season, avoidance of high-quality habitat, and adherence to applicable permit conditions, the overall impact of construction-related activities on terrestrial ecological resources would be SMALL.

The installation of the natural gas pipeline would also result in the clearing of woody and herbaceous vegetation. It is expected the project would displace wildlife along the pipeline corridor. However, the corridor would be revegetated after installation of the pipeline and some wildlife species would reoccupy portions of the corridor. Pipeline installations typically result in temporary disruptions to wildlife. Therefore, the pipeline installation on terrestrial wildlife would be SMALL.

Operational impacts on terrestrial resources would be similar to those occurring with the operation of the ONS plant. Air emissions associated with the plant may cause some impacts to the forested areas adjacent to the plant. Overall, the operation of the NGCC plant would result in SMALL impacts to terrestrial resources.

Aquatic

Impacts on aquatic resources during construction would be minimal through implementation of BMPs, which would minimize impacts from surface water discharges and potential shoreline construction needed to modify existing intake structures. Additionally, no dredging activities are anticipated. The SWPPP BMPs would also minimize potential spills and releases associated with the construction of the plant. Installation of the pipeline could require a USACE Section 404 permit depending on the location and the need to cross any wetlands. The permit would identify proper mitigation techniques for installation of the pipeline at aquatic crossings. Therefore, construction-related impacts on aquatic ecological resources under the NGCC plant alternative are anticipated to be SMALL.

During operations, the NGCC plant would require less cooling water to be withdrawn from Lake Keowee than is required for ONS. The NGCC plant would also require an NPDES permit. Overall, operations-related impacts on aquatic ecological resources under the NCGG plant alternative would be SMALL.

Special Status Species

Special status species addressed in this section include federally and state-listed species and species protected under the MBTA. As discussed in Section 4.6.6, habitat for two federally listed species, the northern long-eared bat and the bog turtle, which is also state-listed, does occur on or immediately adjacent to the ONS site. Habitat for six state-listed species is located on the ONS or the species are highly mobile and may occur on the site. Due to the proximity of the operating ONS plant and SC-183, the areas on the ONS site that would be cleared for the NGCC alternative would be low-quality habitat for these species. Duke Energy would comply with federal, state, and local requirements for land development and wildlife protection.

The acreage across from ONS along SC-183 is primarily forested with a transmission line corridor and associated development. The presence or absence of federally listed and state-ranked species in the project footprint at this offsite acreage cannot be ascertained without field surveys (NRC 2013f, Section 9.3.4.3). In the W.S. Lee Nuclear Station EIS, the NRC reviewed the potential construction-related impacts to protected species at the Keowee site based on 2012 information in the South Carolina rare, threatened, and endangered species inventory

database (NRC 2013f, Section 9.3.4.3). The NRC screened the database for habitat criteria that may be found within the Keowee site's location within the Piedmont ecoregion. The NRC screening resulted in five rare or ranked wildlife species in Oconee County and 44 rare or ranked plant species in Oconee County (NRC 2013f, Section 9.3.4.3, Table 9-12). Only one species was listed at the time, the smooth coneflower, but this species was not known to occur within or near the Keowee site. The NGCC alternative would only disturb a fraction of the land area considered for the Keowee site and could avoid the higher-quality wildlife habitat of hardwood and mixed hardwood forest. Surveys would be undertaken as appropriate to support siting and allow avoidance of sensitive habitats and protected species. Therefore, NO EFFECT is expected for federally or state-listed species.

The natural gas pipeline corridor could cross habitat for federally or state-listed species. The corridor could cross more than one county, so siting the corridor outside of special status species habitat, especially federally listed species, would be a critical path issue in the siting process. If threatened and endangered species habitat could not be avoided in the siting process, field surveys would be required to determine if the species is present within or adjacent to the corridor and appropriate avoidance or mitigation measures would have to be implemented. Depending on the corridor location, installation of the pipeline could result in NO EFFECT to NOT LIKELY to ADVERSELY AFFECT special status species with the implementation of mitigation measures.

Operations of the NGCC plant and pipeline would likely not impact special status species. Ongoing operations activity would be confined to work areas and would not impact habitats potentially occupied by special status species. Pipeline corridor maintenance activities could be modified (e.g., manual cutting, no herbicide use) as necessary to protect special status species, if present. Therefore, impacts to special status species from NGCC plant operations species would result in NO EFFECT.

7.2.3.1.8 Historic and Cultural Resources

The proposed NGCC plant would be sited within the existing ONS property, with some portions potentially sited on adjacent Duke Energy-owned property across SC-183. A cemetery exists onsite at the entrance to the plant along SC-183 and an NRHP site, the Old Pickens Presbyterian Church and Cemetery, is located adjacent to ONS to the southeast (see Section 3.8). The NGCC site would abut the onsite cemetery and would thus require site investigation to confirm the burial ground's boundaries and ensure appropriate fencing is in place to preserve the integrity of the site. Portions of the NGCC site would also share a border with the Old Pickens Presbyterian Church and Cemetery. The Old Pickens Presbyterian Church and Cemetery are surrounded by trees, which aids in mitigating the potential for construction-related impacts (e.g., noise, viewshed, and fugitive dust).

As noted above, the Duke Energy-owned property across SC-183, the Keowee site, was considered as an alternative site for W.S. Lee Nuclear Station. No cultural resources investigations were completed; however, simple predictive modeling analyses completed by

Duke Energy indicated that portions of the site exhibited high potential for additional cultural resources (i.e., well-drained soils, less than 15 percent slope, outside active floodplains or areas of seasonal or permanent inundation, largely undisturbed). The NRC's assessment of a 1-mile buffer area of the 450-acre Keowee site considered seven cultural resources in the indirect visual APE, including one Native American mound site, five prehistoric archaeological sites, and one NRHP site (i.e., the Old Pickens Presbyterian Church and Cemetery). (NRC 2013f) For the NGCC alternative, the cultural resources surveys conducted on the approximately 30 acres needed would identify any sites, and they would be avoided and/or protected during construction.

Duke Energy's site planning process would seek to avoid or mitigate impacts to cultural resources. This would include coordination with the South Carolina SHPO, the South Carolina state archaeologist, interested American Indian tribes, and the public, and potentially require field investigations. The results of these investigations and communications would be used in the site planning process to avoid or mitigate impacts and develop protective measures for any significant resources such as those already listed on the NRHP.

The cultural resources survey conducted before construction would identify any sites, which would be avoided during construction of the pipeline. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), potential NHPA Section 106 consultation would be required if cultural resources are impacted by the proposed activities.

During operations air emissions could contribute to corrosive atmospheric conditions and reduced visibility. The plant would have to comply with Title IV of CAA [42 USC 7651] reduction requirements for SO_2 and NO_x, which are the main precursors of acid rain and the major causes of reduced visibility. The NRHP site's headstones and masonry could experience increased deterioration from acid rain.

Given the NRHP site's proximity to the NGCC site and the potential for impacts to extend throughout the operational period, the NGCC plant poses an adverse effect to the Old Pickens Presbyterian Church and Cemetery; however, without atmospheric modeling, noise and vibration studies, and a viewshed study, the project's effects are indeterminable. Other cultural resources, both historic and archaeological, could potentially be avoided or protected during both the NGCC plant construction and operations, and construction of a natural gas pipeline to connect the plant to the natural gas supply pipelines. Conservatively, with an existing NRHP site adjacent to the NGCC alternative site, the construction- and operation-related impacts to cultural resources would be ADVERSE EFFECT.

7.2.3.1.9 Socioeconomics

The jobs created to complete the construction of the NGCC plant and natural gas pipeline would be temporary. It is expected some of the workers associated with the construction activity may relocate to the area during construction of these facilities. However, most of these workers would return to their permanent places of residence at the completion of the construction.

Therefore, any boost to the local economy would be short-term, and socioeconomic impacts related to the construction of the plant would be SMALL.

Duke Energy estimated that approximately 150 regular full-time employees would be needed for NGCC plant operations as an alternative to the proposed W.S. Lee Nuclear Station plant (NRC 2013f). This number of workers is significantly less than ONS's current regular full-time employment of 698 (Table 2.5-1). Workers employed at the NGCC plant are assumed to live in Oconee and surrounding counties. They would contribute to the local economies via housing, living expenses, taxes, and other revenue contributions. Jobs associated with the operation of the NGCC plant would contribute long-term socioeconomic benefits. Some economic loss would be expected in communities where ONS employees live and shop because fewer workers will be employed at the NGCC plant.

Duke Energy would pay property taxes for the plant to local taxing districts. The tax payments attributable to Duke Energy-owned property are approximately 73 percent of the FY 2019 total property tax revenues of Oconee County (Section 3.9.5). For an NGCC plant at the ONS site and adjacent Duke Energy-owned property, property tax payments would continue to be a significant impact on Oconee County. Overall, the operations-related socioeconomic impacts of an NGCC plant would be MODERATE beneficial.

Transportation

Construction of the NGCC plant would increase vehicle traffic on the roads accessing the ONS property. The principal road access to ONS is SC-183 (east-west) and SC-130 (north-south), which are two-lane paved roads. It is expected that equipment used in construction would also be shipped via these highways. This increase in traffic would be short-term, noticeable, and could exceed local roadway capacity during peak times given that existing ONS units would remain operational during construction. Mitigation measures such as staggering shifts and deliveries would be used as needed. Therefore, construction traffic impacts would be MODERATE.

Traffic impacts associated with the operation of the NGCC plant would be minimal. Some increase in road use may occur as ONS is decommissioned and NGCC plant operations are initiated. Overall, because the operations of the NGCC plant would require fewer workers, operations-related transportation impacts under the NGCC plant alternative would be SMALL.

7.2.3.1.10 Human Health

Human health impacts associated with the construction of the NGCC plant alternative and natural gas pipeline connection would be primarily related to potential accidents and injuries resulting from accidents. Worker safety would be addressed by adherence to Occupational Safety and Health Administration (OSHA) worker protection and other initiatives such as contractor safety meetings. The radiological human health impact on construction workers due to working in proximity to ONS would be SMALL due to compliance with NRC regulations and adherence to as low as reasonably achievable (ALARA) principals. Construction activities

should not have any impact on local residents because the impacts would primarily be restricted to the ONS property. Therefore, construction-related impacts on human health under the NGCC plant alternative would be SMALL.

Impacts resulting from the operation of the NGCC plant would primarily be from air pollutant emissions. The NGCC plant would emit criteria air pollutants (Table 7.2-1). Some pollutants, such as NO_x, contribute to ozone formation that can create health problems. These criteria pollutants are regulated, and technology will be installed in the plant to limit the criteria air pollutant releases. Plant operation human health impacts would also be avoided and minimized from adherence to safety standards. Overall, the operations-related impacts to human health under the NGCC plant alternative would be SMALL.

7.2.3.1.11 Environmental Justice

Section 3.11 presents the minority and low-income population in the region surrounding the ONS site. The closest block group that meets the criteria for a minority population is Block Group 450730307013, located approximately 8 miles south-southwest of the site. The closest low-income block group that meets the guidance criteria for individuals or families is Block Group 45077011204, which is located adjacent to the ONS site. The locations of block groups within the 50-mile region that meet the criteria for a minority population are illustrated in Figures 3.11-1, 3.11-2, 3.11-3, 3.11-4, 3.11-5, 3.11-6, 3.11-7, 3.11-8, 3.11-9, 3.11-10, 3.11-11, 3.11-12, 3.11-13, and 3.11-14. The locations of block groups within the region that meet the low-income guidance criteria for either families or individuals are illustrated in Figures 3.11-15, 3.11-16, 3.11-17, and 3.11-18.

For W.S. Lee Nuclear Station, the NRC considered the physical impacts of the Keowee alternative from building activities (e.g., noise, fugitive dust, air emissions, and traffic) and their proximity to the nearest minority and low-income populations. At the time of the W.S. Lee Nuclear Station EIS preparation, the nearest minority population was about 5 miles away from the Keowee site and the nearest low-income census blocks were adjacent to the Keowee site. This is similar to the location of the nearest minority and low-income populations described in Section 3.11 based on the most recent U.S. census. The NRC determined that there would be no physical impacts with a disproportionately high and adverse effect on minority or low-income populations. The NRC determined that the impacts of operation of a nuclear power plant at the Keowee site would be unlikely to have a disproportionately high and adverse impact on minority or low-income populations. (NRC 2013f)

Potential impacts from construction of an NGCC plant would primarily be associated with socioeconomic effects. These impacts would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the project. The closest low-income or minority population is adjacent to the Keowee site on the Pickens County side of the site. This area, the closest low-income population, could experience temporary increased traffic along the local roadways. However, construction traffic traveling through this low-income area rather than traffic originating within the low-income area

would affect the low-income population at the same level as would be experienced by other nearby population areas traversed by construction traffic. The increase in traffic on roads would likely result in no disproportionately high and adverse effects to local low-income and minority communities. Overall, environmental impacts would be minor and would not result in disproportionately high and adverse effects to low income and minority communities.

No disproportionately high and adverse impacts to minority or low-income populations are expected to occur for operations of the NGCC plant alternative because the activities associated with operating plant would be similar to those occurring at ONS with the exception of air emissions, which would be subject to permit and regulatory restrictions.

7.2.3.1.12 Waste Management

The construction of the NGCC plant would generate land-clearing waste that would be recycled for use (e.g., wood chips for mulch, dirt for fill) or sent to area construction and demolition (C&D) landfills. If structures are demolished to site the NGCC, scrap metal and other material would be recycled if practical and the remainder sent to area C&D landfills. Construction activities would also generate sanitary and industrial wastes. These wastes will be properly managed onsite and disposed at approved offsite treatment or disposal facilities. Therefore, construction-related waste impacts would be SMALL.

Operation of the NGCC plant alternative would result in different waste streams being created from spent catalytic reduction catalysts used to control nitrous oxide emissions. This waste stream is considered hazardous and would be disposed of at a facility that handles hazardous materials. Other waste generated at the site would be characterized as hazardous or non-hazardous. These wastes would be properly managed and disposed in a permitted offsite facility. Recycling and waste minimization programs would also be implemented to minimize waste streams at the plant. Therefore, waste management impacts expected during operation of the NGCC plant would be SMALL.

7.2.3.2 New Nuclear

As described in Section 7.2.1.2, the new nuclear alternative includes an ALWR plant and an SMR cluster at the ONS site. The ALWR component is the proposed W.S. Lee Nuclear Station in Cherokee County, SC. The NRC issued a COL for W.S. Lee Nuclear Station effective December 19, 2016 (NRC 2016). W.S. Lee Nuclear Station is projected to provide 1,117 MWe net per unit when in operation (NRC 2013f) for a total of 2,234 MWe. The plant's cooling system would include a set of two circular mechanical draft cooling towers with makeup water sourced from stormwater and the Broad River. The NRC issued a final EIS for W.S. Lee Nuclear Station (NRC 2013f). The balance of the replacement power need, 384 MWe, would be supplied by an SMR cluster at the ONS site. Assuming a capacity factor of 90 percent (EIA 2019a), the SMR facility would have a design capacity of 427 MWe. Duke Energy assumes that the SMR facility would utilize mechanical draft cooling towers and, like ONS, would use Lake Keowee for cooling water makeup and discharge. The existing intake and discharge structures would be used, with

some modifications and pump replacement as appropriate. The existing transmission infrastructure is assumed to be sufficient.

7.2.3.2.1 Land Use

The W.S. Lee Nuclear Station would make use of a site with a history of industrial land disturbance that is large enough to accommodate the new facilities without substantial encroachment into environmentally sensitive areas and that does not conflict with zoning or surrounding land uses. However, building a water reservoir, make-up pond C, would require acquisition of approximately 2,110 acres of previously undisturbed rural land and long-term termination of agricultural and other rural land uses thereon. Additional land would be affected by building about 31 miles of new transmission lines. New transmission line corridors would occupy approximately 987 acres of land. Other offsite land-use impacts would be limited. The NRC determined the construction and preconstruction impact of W.S. Lee Nuclear Station to be MODERATE. (NRC 2013f, Table 4-8)

Land uses at the W.S. Lee Nuclear Station would not change during plant operations. Access to make-up pond C will be restricted, and some temporary closures of part of Rolling Mill Road may occur during maintenance of the pond's associated water pipeline corridor connecting the pond to the station's cooling water system. The NRC determined the impact due to operation of W.S. Lee Nuclear Station to be SMALL. (NRC 2013f, Table 5-20)

The land requirement for the SMR facility would be less than that of a conventional nuclear power plant. One of the SMR design developers, NuScale, stated that the land requirement of an SMR facility of 1,000 MWe is less than 20 percent of that required for a 1,000 MWe conventional nuclear plant (NuScale 2019a). Duke Energy assumes that the onsite area proposed for the NGCC alternative, a total of 100 acres, would be sufficient for the siting the SMR facility. The impact on land use due to construction and operation of the SMR facility at the ONS site would be similar to those associated with the NGCC plant alternative presented in Section 7.2.3.1.1, which were determined to be SMALL.

Overall, the land use impacts expected with the new nuclear alternative would be MODERATE for construction of the W.S. Lee Nuclear Station component, SMALL for operations, and SMALL for the SMR facility.

7.2.3.2.2 Visual Resources

The W.S. Lee Nuclear Station site is bounded by woods and water features. Project-related activities would be visible to those using the Broad River and Ninety-Nine Islands Reservoir. The tallest structures onsite during construction are expected to be the meteorology tower and cranes. The most visible structures onsite during operations would be the reactor domes, which would be visible from local and state parks in the surrounding area. Developing make-up pond C would involve clearing forested land, which could negatively affect the viewshed along SC-329 and residents in the vicinity of the make-up pond C site. The NRC determined the visual impact of W.S. Lee Nuclear Station to be MODERATE. (NRC 2013f, Section 4.4.1.4)

The SMR facility at the ONS site is assumed to be constructed in the same area as discussed for the NGCC alternative. Visual impacts would be less than as those described for the NGCC alternative in Section 7.2.3.1.2 because the SMR will not require tall exhaust stacks. Therefore, the visual resource impacts associated with construction and operation of the SMR facility would be SMALL.

7.2.3.2.3 Air Quality

Temporary and minor effects on local ambient air quality could occur as a result of normal project activities at the W.S. Lee Nuclear Station site and the development of make-up pond C. Fugitive dust and fine particulate matter would be generated during earthmoving activities, material-handling activities, by wind erosion, and other activities at borrow areas, laydown areas, access roads, and transmission line and pipeline corridors. Specific mitigation measures to control fugitive dust would be identified in a dust control plan. Vehicles used to haul debris, equipment, and supplies as well as equipment used for cutting, clearing, and mulching at the make-up pond C area would create pollutants. Mitigation measures (e.g., paving or stabilizing disturbed areas, water suppression, reduced material handling) would minimize such emissions. All equipment would be serviced regularly, and all industrial activities would be conducted in accordance with federal, state, and local emission requirements. The NRC determined the air quality impacts from preconstruction and construction activities to be SMALL. (NRC 2013f, Section 4.4.1 and Table 4-8)

Air quality impacts from operation of the W.S. Lee Nuclear Station would include intermittent releases from four standby diesel generators, four ancillary diesel generators, and two secondary diesel-driven fire pumps. In addition, the technical support center would use one diesel generator. Duke Energy would obtain an operating permit through the SCDHEC. The standby generators and pumps will likely be classified as minor sources due to limited operational use. Air quality impacts would also result from vehicular emissions associated with plant operations. Potential impacts from operation of W.S. Lee Nuclear Station on air quality from emissions of criteria pollutants, CO_2 emissions, cooling system emissions, and transmission lines would be minimal. The NRC determined the air quality impacts to be SMALL. (NRC 2013f, Sections 5.7.2 and 5.7.4 and Table 5-20)

Construction activities for an SMR facility that could impact air quality would be similar to the NGCC alternative, with the generation of fugitive dust and construction vehicle emissions (see Section 7.2.3.1.3). The SMR facility's air emissions are anticipated to be similar to ONS's emissions with the addition of air emissions from the mechanical draft cooling towers as discussed in Section 7.2.3.1.3. Duke Energy would be required to obtain construction and operating permits for the SMR facility through the SCDHEC or modify the existing permit. Through adherence to permit conditions, the impacts of an SMR facility on air quality would be SMALL.

GHG emissions associated with nuclear power are lower than fossil fuel-based energy sources. Nuclear power life-cycle GHG emissions are within the same order of magnitude as renewable

energy sources (NRC 2013a, Section 4.12.3). The new nuclear alternative would have greatly reduced GHG emissions compared to emissions from a fossil fuel plant.

7.2.3.2.4 Noise

Sources of noise during construction of the W.S. Lee Nuclear Station site would include clearing, earthmoving, foundation preparation, pile driving (if needed), concrete mixing and pouring, steel erection, and various stages of facility equipment fabrication, assembly, and installation. Additionally, a substantial number of diesel- and gasoline-powered vehicles and other equipment would be used. Projected noise levels from most building activities would have levels below background levels (50 to 55 dBA) and below the 60 to 65 dBA range of acceptable day-night, 24-hour average (Ldn) noise levels set by the U.S. Department of Housing and Urban Development. Building activities above the Ldn range of 60 to 65 dBA would be temporary. Other sources of noise are from transmission line development and traffic-related noise. Transmission line construction noise is similar to building activities onsite, except that is has a shorter duration at each location along the corridor. W.S. Lee Nuclear Station workforce traffic and heavy equipment deliveries would increase noise along McKowns Mountain Road. Noise generated from building make-up pond C would temporarily increase noise levels at nearby residences. All project activities would also be subject to regulations from the Noise Control Act of 1972, federal regulations for noise from construction equipment (40 CFR Part 204), OSHA regulations (29 CFR 1910.95), and state regulations. The NRC anticipated that noise impacts on recreation and the public would be minimal with the use of the mitigation actions included in the above regulations (as applicable), and also because noise attenuates rapidly with distance, intervening vegetation, and variations in topography. Consequently, the NRC concluded that noise impacts on surrounding communities from these project building activities would be negligible. (NRC 2013f, Section 4.4.1 and Table 4-8)

Noise sources associated with the operation of W.S. Lee Nuclear Station would include pumps, cooling towers, transformers, switchyard equipment, and loudspeakers. Many of these noise sources are confined indoors or are infrequent. The main sources of noise would be the four mechanical draft cooling towers. The overall projected combined ambient and cooling-tower noise levels range from approximately 48 to 64 dBA. Given the postulated noise levels for mechanical draft cooling towers and diesel generators, the site characteristics and noise attenuation, the NRC determined that potential noise impacts associated with operation of W.S. Lee Nuclear Station would be SMALL. (NRC 2013f, Sections 5.8.2 and Table 5-20)

Construction activities and associated noise levels for an SMR facility would be like those of the NGCC alternative (Section 7.2.3.1.4). Like the NGCC alternative, the construction activities would occur on the south side of ONS away from the lakeside residential areas, allowing for attenuation of sound levels prior to reaching these neighborhoods. The operating SMR would have noise sources and levels similar to the ONS with the addition of the mechanical draft cooling towers. As described in Section 7.2.3.1.4, the sound from the cooling towers will attenuate prior to reaching offsite areas. Therefore, construction and operations-related noise impacts associated with the SMR component of the new nuclear alternative would be SMALL.

7.2.3.2.5 Geology and Soils

Construction of the plant, reservoir, and corridors for W.S. Lee Nuclear Station could result in erosion and sediment and dissolved solids entering the Broad River from the London Creek drainage. The activities would be regulated by a combination of NPDES and USACE permitting, adoption of a SWPPP, and use of BMPs. Installation of the discharge structure within the FERC project boundary line and mitigation measures required to prevent and/or minimize erosion, sediment and dissolved solids from entering the Broad River would be under the jurisdiction of the FERC. Stormwater runoff and water from excavation dewatering in the immediate vicinity of proposed Units 1 and 2 would be managed to drain into make-up pond A, make-up pond B, and the Broad River at permitted outfalls. Duke Energy would use BMPs for soil erosion controls and comply with applicable stormwater regulations designed to prevent stormwater runoff from affecting the water quality in the Broad River and small streams in the vicinity of the site. New transmission tower and line installation activities would comply with state and federal guidelines, and BMPs would be used to minimize impacts on water quality from erosion and sedimentation. The NRC did not specifically address geology and soil impacts. Through the implementation of the SWPPP and BMPs, the NRC concluded that the impacts on surface water quality from activities related to construction and preconstruction of W.S. Lee Nuclear Station would be SMALL. (NRC 2013f, Section 4.2.3.1) Through compliance with permit conditions, adherence to stormwater regulations, and applying SWPPP mitigation and BMPs, construction-related impacts on geology and soils would be SMALL.

Operations-related impacts on geology and soils from W.S. Lee Nuclear Station would be minimized by adherence to management of stormwater originating from the site. BMPs would minimize stormwater discharges from the site. Therefore, operations-related impacts would be SMALL.

The SMR facility would be sited on the ONS site and require land disturbance that would be subject to a SCDHEC stormwater permit and require a site-specific SWPPP. The impact on geology and soils due to construction and operation of the SMR facility at the ONS site would be SMALL and similar to, but less than those, associated with the NGCC plant alternative (see Section 7.2.3.1.5) given that the SMR facility would not require the development of the property across SC-183.

7.2.3.2.6 Hydrology (Surface Water and Groundwater)

Surface Water

Water needs for construction at the W.S. Lee Nuclear Station site would be similar to typical uses of water for large industrial projects. These uses include dust abatement, concrete mixing, and potable water needs. The impacts of construction and preconstruction activities on surface water would be of limited duration. Peak water demands would represent a small portion of the available water from the Draytonville Water District. The NRC concluded that the impacts on surface water use during construction and preconstruction activities for the proposed W.S. Lee Nuclear Station would be SMALL. (NRC 2013f, Section 4.2.2.1)

Construction of W.S. Lee Nuclear Station's plant, reservoir, and corridors could result in erosion, with sediment and dissolved solids entering the Broad River from the London Creek drainage. Construction activities could result in increased stormwater runoff from cleared sites, and spills and leaks from construction equipment. Construction activities would be regulated by a combination of NPDES and USACE permitting, FERC authorizations, adoption of a SWPPP, and use of BMPs. These BMPs and waste management practices identified in the SWPPP would also capture and mitigate accidental spills from equipment and vehicles. Through the implementation of the SWPPP and BMPs, the NRC concluded that the impacts on surface water quality from activities related to construction and preconstruction of proposed W.S. Lee Nuclear Station Units 1 and 2 would be SMALL. (NRC 2013f, Section 4.2.3.1)

Impacts on surface water quality from the operation of W.S. Lee Nuclear Station are limited to residual heat in blowdown water, water treatment chemicals in blowdown water, and concentrated solutes from the Broad River. Sanitary wastewater would be transferred to a public wastewater treatment plant. The NRC concluded that the impacts on surface water quality from operations of the proposed W.S. Lee Nuclear Station Units 1 and 2 would be SMALL. (NRC 2013f, Section 5.2.3.1)

The SMR facility would be sited on the ONS site and require land disturbance that would be subject to a SCDHEC stormwater permit and require a site-specific SWPPP. The impact on surface water quality due to construction of the SMR facility at the ONS site would be SMALL and similar to, but less than those, associated with the NGCC plant alternative presented in Section 7.2.3.1.6 given that the SMR facility would not require the development of the property across SC-183.

Duke Energy assumes the ONS intake and discharge structures will be used, with some modification, for the SMR facility and cooling would be once-through, as it is for ONS. A new NPDES permit or modifications to the existing permit would be required for the NGCC plant. Water demand would be substantially less than for ONS due to the smaller design capacity of the SMR facility. The SMR plant would have water withdrawals of approximately 11 MGD and consume approximately 6.4 MGD based on water use factors developed by the NETL of 1.01 gal/kWh for withdrawals and 0.624 gal/kWh for consumption (NETL 2010b, Appendix D). Cooling water treatment additives would be required for the closed-cycle cooling system to prevent scaling and bio-fouling. The use and discharge of the chemicals would be governed by the plant's NPDES permit. Surface water impacts from operating the SMR facility would be SMALL.

Groundwater

Groundwater would not be used as a water-supply source during construction or operations at W.S. Lee Nuclear Station. Excavations at the W.S. Lee Nuclear Station site and make-up pond C would require dewatering. The potential drawdown from the nuclear island foundations was estimated to extend approximately 1,700 feet, well away from the nearest residential groundwater supply well. The drawdown from make-up pond C was similarly estimated to be localized. Upon completion of make-up pond C, groundwater levels would rise in the vicinity of

the impoundment area and come into equilibrium. The NRC concluded the overall groundwater impacts from construction and preconstruction activities would be of limited magnitude, localized, and temporary, and therefore SMALL. (NRC 2013f, Section 4.2.2.2)

The only impact on groundwater quality at W.S. Lee Nuclear Station would be from spills, the stormwater management system, or from fluctuations in the elevation of make-up pond C. BMPs would be applied to prevent spills and minimize their effects. The spill prevention, control, and countermeasure plan will mitigate impacts on local groundwater because spills would be quickly attended to and not allowed to penetrate to groundwater. The NRC concluded that the groundwater quality impacts of proposed W.S. Lee Nuclear Station Units 1 and 2 and make-up pond C operations would be SMALL. (NRC 2013f, Section 5.2.3.2)

Groundwater use and quality for the SMR facility at ONS would be SMALL and similar to that of the NGCC plant alternative presented in Section 7.2.3.1.6, given the same location; the same construction activities, permit conditions, BMPs; and implementation of SWPPPs and SPCC plans.

7.2.3.2.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial

Site preparation and development for the W.S. Lee Nuclear Station would involve construction activities at/for the site, the make-up pond C site, two new transmission line corridors, the existing railroad spur corridor, and offsite road improvements. Construction activities would be conducted according to federal and state regulations, permit conditions, and established BMPs. Duke Energy would work with the USACE to determine appropriate mitigation through the permitting process of CWA Section 404. Impacts are primarily from the make-up pond C and in the transmission line corridors. (NRC 2013f, Section 4.3.1)

Development at the W.S. Lee Nuclear Station site would impact approximately 946 acres, including temporary habitat alteration (327 acres) and permanent habitat loss (619 acres). A substantial portion of the impacts would occur in previously disturbed, low-quality habitat. Site preparation and development and inundation of make-up pond C would permanently alter the nature of the terrestrial habitat and wildlife resources in the London Creek watershed. Creation of make-up pond C would affect about 821 acres of forest (of which about 545 acres are relatively undisturbed mixed hardwood and mixed hardwood-pine forest) along most of the length of London Creek and its tributaries. Development of make-up pond C would inundate seven significant natural areas, four noteworthy ecological associations of concern to the state, occurrences of five uncommon plant species, diverse amphibian and reptile assemblages, 3.55 acres of jurisdictional wetlands, and vegetation along 884 linear feet of jurisdictional streams. Creation of make-up pond C would also alter the functionality of the London Creek corridor as a wildlife travel corridor, particularly for neotropical migrant songbirds of conservation priority. Site preparation and development of the proposed two new transmission line corridors would permanently disturb about 690 acres of upland forest habitat in Cherokee and Union counties and 1.15 acres of jurisdictional wetlands. Transmission system installation would involve 7.6

miles of streams, 116 stream crossings, and about 11 acres of jurisdictional wetlands. (NRC 2013f, Section 4.3.1)

For W.S. Lee Nuclear Station, NRC determined that the related impacts of habitat loss and wildlife mortality, disturbance, and displacement would be substantial and mostly permanent in nature, largely due to the effects of inundation. SCDNR indicated that the London Creek watershed and the habitat and wildlife resources found there represent intact examples of other watersheds with similar resources in the South Carolina upstate Piedmont. Overall, the NRC concluded that construction and preconstruction impacts on habitat and associated wildlife would be MODERATE, noticeable but not destabilizing to such resources across the Piedmont ecoregion. (NRC 2013f, Section 4.3.1)

The potential impacts of operating W.S. Lee Nuclear Station and the associated cooling system (mechanical draft cooling towers) on vegetation, birds, and shoreline habitat are likely to be minor. The potential impacts of transmission line operation on birds, and transmission line corridor maintenance on important habitats, including floodplains and wetlands, are considered minor, assuming related BMPs are implemented. The potential impacts of water pipeline corridor maintenance, increased traffic, wastewater treatment basin operation, dredged material disposal, railroad spur operation, and nighttime security lighting on wildlife are likely to be minor. The NRC concluded the impacts from operation of the proposed new facilities and associated new transmission lines on terrestrial resources would be SMALL. (NRC 2013f, Section 5.3.1.6)

The terrestrial ecology setting for the ONS site is discussed in Section 3.7.2. Construction activities of the SMR facility would be confined to the ONS site, primarily utilizing developed land, open space next to operating industrial facilities. Prior to tree removal, wildlife surveys would be conducted as done for recent expansion of the onsite ISFSI, to identify protected species and habitat and design appropriate avoidance and minimization measures. Given that the SMR facility would be constructed on an operating industrial site and Duke Energy would take appropriate mitigation measures prior to tree removal, the construction of an SMR facility would have a SMALL impact on terrestrial ecology. The operating SMR facility would have the same types of operational noise and emissions as ONS, with the exception of noise and emissions from the mechanical draft cooling towers. An operating SMR facility at ONS would have a SMALL impact on terrestrial ecology.

Aquatic

Site construction and preconstruction activities associated with W.S. Lee Nuclear Station involve potential impacts on aquatic biota in the Broad River and Ninety-Nine Islands Reservoir and onsite ponds and streams; inundation of London Creek and its tributaries; and potential impacts to other offsite waterbodies associated with transmission line corridors. Construction activities would affect 29.63 acres of open water and 67,285 linear feet of streams. In consultation with the USACE, Duke Energy would design compensatory mitigation appropriate to offset impacts on wetlands, streams, and other waters of the United States within the jurisdiction of the CWA. (NRC 2013f, Section 4.3.2.4)

Most of the riparian habitat of the mainstem London Creek would be lost. Although the aquatic resources found in London Creek are not unique to the region, the habitat type is becoming increasingly rare as development in the region increases. In time, the lacustrine aquatic habitat of the new reservoir would be valuable for other reasons, but it does not mitigate the loss of riparian habitat within a Piedmont watershed. The NRC concluded that the impacts on aquatic resources from the combined construction and preconstruction activities for W.S. Lee Nuclear Station would be MODERATE, primarily because of the loss of a major portion of London Creek and its aquatic biota. (NRC 2013f, Section 4.3.2.4)

The potential for aquatic ecology impacts from operation of W.S. Lee Nuclear Station involve the associated Broad River intake system, make-up ponds A, B, and C intake and discharge systems, Broad River discharge system, and transmission line corridors on aquatic resources. Impingement and entrainment impacts to the aquatic ecology of the site and environs from operation of the Broad River intake structure are likely to be minimal due to the use of closed-cycle cooling and the location and design of the intake structure. Impacts to aquatic biota from operation of intakes in make-up ponds A, B, and C are also likely to be minor. Impacts on aquatic organisms in the Broad River due to the discharge could result from thermal, chemical, and physical effects on the substrate and hydrological changes. Thermal impacts on fish populations from the discharge of heated water from the proposed W.S. Lee Nuclear Station are expected to be minor because of the small increase in temperature over ambient conditions and the small extent of the thermal plume. Based on the estimated discharge concentrations and the water treatment chemicals planned, the impacts from chemical discharges to the Broad River are expected to be minimal. The NRC concluded that the aquatic ecological impacts to the Broad River, the onsite ponds, make-up pond C, and waters crossed by the transmission line corridors from the operation and maintenance of W.S. Lee Nuclear Station facilities and associated new transmission lines would be SMALL. (NRC 2013f, Section 5.3.2.5)

Construction impacts from the SMR facility at ONS on aquatic resources would be minor because BMPs would be used to minimize impacts from shoreline construction to modify existing intake structures, no dredging is anticipated, and surface water discharges to aquatic habitat would be minimized through installation of BMPs identified in the SWPPP. The SWPPP BMPs would also eliminate or minimize potential spills and releases associated with the construction of the plant. Duke Energy assumes the installation and proper placement of BMPs during construction of the NGCC plant would result in SMALL impacts to aquatic resources.

The SMR facility would require substantially less water to be withdrawn from Lake Keowee for cooling than is required for ONS due to the smaller design capacity of the SMR facility and closed-cycle cooling water makeup requirements. Entrainment impacts would be less than those of ONS given the smaller water volume drawn into the plant; impingement impacts from through-out velocity would be similar. Therefore, the impingement and entrainment impact of an SMR facility at ONS would be SMALL and similar to those of ONS.

The cooling water treatment additives would be governed by the plant's NPDES permit. An SMR facility would be required to meet NPDES discharge limits. Overall, the operations-related

impacts to aquatic resources under the SMR component of the new nuclear alternative would be SMALL.

Special Status Species

The NRC's W.S. Lee Nuclear Station environmental impact statement indicated that there would be no impacts to known federally threatened, endangered, proposed, or candidate animal or plant species and no impacts to known state-listed species from the proposed W.S. Lee Nuclear Station, including make-up pond C, and the two proposed transmission lines and railroad spur, and maintenance of transmission line corridors, water pipeline corridors, and offsite road improvements. There are no areas designated as critical habitat for threatened and endangered species in the vicinity of the W.S. Lee Nuclear Station site. (NRC 2013f, Tables 2-9, 2-13, Sections 4.3.1.6, 4.3.2.3, 5.3.1.3, and 5.3.2.3; 79 FR 56041)

The USFWS concurred with the NRC's determination that the proposed W.S. Lee Nuclear Station project is not likely to adversely affect federally protected species or result in adverse modification to designated or proposed critical habitat. In a letter to the National Marine Fisheries Service (NMFS), the NRC staff documented its no-effect determination for the shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*A. oxyrinchus oxyrinchus*), and considered its consultation with NMFS under the ESA, Magnuson-Stevens Fishery Conservation and Management Act, and Fish and Wildlife Coordination Act for the proposed W.S. Lee Nuclear Station to be complete. (NRC 2013f, Sections 4.3.1.6, 4.3.2.3, 5.3.1.3, and 5.3.2.3)

One state-listed fish species, the Carolina fantail darter *(Etheostoma brevispinum*) has been found in areas potentially affected by operation of the proposed W.S. Lee Nuclear Station. The Carolina fantail darter has been captured in the vicinity of the proposed Broad River intake structure. Impacts to the state-listed Carolina fantail darter fish species are expected to be minimal based on its habitat preferences and adhesive egg-laying characteristics. (NRC 2013f, Section 5.3.2.3)

Special status species at the ONS site are discussed in Section 4.6.6. There is habitat for two federally listed species, the northern long-eared bat and the bog turtle, and six state-listed highly mobile species potentially occurring on the ONS site. There are no federally or state-listed aquatic species found in Lake Keowee. Construction activities for the SMR facility would be confined to the ONS site, primarily utilizing developed land and open space next to operating industrial facilities. Prior to tree removal, wildlife surveys would be conducted as done for recent expansion of the onsite ISFSI, to identify protected species and habitat and design appropriate avoidance and minimization measures. Given that the SMR facility would be constructed on an operating industrial site and Duke Energy would take appropriate mitigation measures prior to tree removal, the construction of an SMR facility would have NO EFFECT on special status species. Ongoing operations activity would be confined to work areas and would not impact habitats potentially occupied by special status species. The operating SMR facility would have similar types of operational noise and emissions as ONS with the addition of noise and emissions from the mechanical draft cooling towers. Sound levels will attenuate with distance

and the surrounding structures and air emissions will be governed by permit standards and limitations. Like for ONS, SMR operations would likely not impact federal-or state-listed species. Therefore, operations-related impacts to special status species would result in NO EFFECT.

7.2.3.2.8 Historic and Cultural Resources

Investigators identified four historic cemeteries within the 1,900-acre W.S. Lee Nuclear Station site, none eligible for nomination to the NRHP, but protected by state law. Under the W.S. Lee Nuclear Station cultural resources management plan and associated memorandum of agreement (MOA), Duke Energy intends to continue to provide public access to these culturally important resources, establish protective 50-foot buffers as necessary, and maintain the fences that surround them. Prior to ground disturbance, the cemeteries will be marked for avoidance. Duke Energy would also consult with the South Carolina SHPO on the future removal and relocation of the family cemetery located in the make-up pond C site. No traditional cultural places of importance to interested American Indian tribes have been identified at the W.S. Lee Nuclear Station site. The NRC concluded that potential direct and indirect impacts on historic and cultural resources during construction and preconstruction in the 1900-acre W.S. Lee Nuclear Station site and make-up pond C site would be MODERATE. Provided that federal agencies, the state SHPO, and interested American Indian tribes agree that none of the archaeological or architectural resources recorded within defined indirect and direct APEs at the W.S. Lee Nuclear Station site or make-up pond C site are eligible for the NRHP, construction activities will have NO ADVERSE EFFECT on historic properties or traditional cultural resources. (NRC 2013f, Section 4.6.1)

With implementation of Duke Energy's cultural management plan and adherence to MOA with the USACE, South Carolina SHPO, and the Catawba Indian Nation tribal historic preservation officer (THPO), operations at W.S. Lee Nuclear Station would have SMALL impact on cultural resources and NO ADVERSE EFFECT to historic properties (NRC 2013f, Section 5.6).

The SMR option would be sited within the existing ONS property. A cemetery exists onsite at the entrance to the plant along SC-183 and a NRHP site, the Old Pickens Presbyterian Church and Cemetery, is located along the southeast ONS border (see Section 3.8). The SMR site would abut the onsite cemetery and would require site investigation to confirm the burial ground's boundaries and ensure fencing is in place to preserve the integrity of the site. Portions of the SMR site would also share a border with the Old Pickens Presbyterian Church and Cemetery property. The grounds of the Old Pickens Presbyterian Church and Cemetery are not contiguous with the ONS property line and are surrounded by trees, mitigating the potential for impacts from construction activities (e.g., impacts from noise and fugitive dust) as well as visual impacts from construction or operations.

Duke Energy's site planning process would seek to avoid or mitigate impacts to cultural resources. This would include coordination with the South Carolina SHPO, South Carolina state archaeologist, interested American Indian tribes, and the public. Any new construction would follow all state and federal requirements and the appropriate field studies would be conducted to

identify resources and avoid or mitigate construction or operational impacts. The results of these investigations and communications would be used in the site planning process to avoid or mitigate impacts and develop protective measures for any significant resources such as those already listed on the NRHP.

It is anticipated that noise levels would be similar to those from ONS and the height of an SMR containment structure would be less than that of ONS. One SMR design, the NuScale, has a containment vessel height of 76 feet (NuScale 2019b), while the highest ONS reactor building is approximately 190 feet above grade. Because cultural resources, both historic and archaeological, would be avoided or protected during construction and anticipated impacts from operations would be small, NO ADVERSE EFFECT would be expected to occur to cultural resources.

7.2.3.2.9 Socioeconomics

Socioeconomic Issues other than Transportation

The construction and operation of W.S. Lee Nuclear Station would create construction and power plant operations employment. The construction employment would be short-term and would provide a stimulus to the local economy. Plant operations employment would be long-term and would provide additional stimulus to the local economy.

The NRC considered the socioeconomic impacts from the construction of two units at W.S. Lee Nuclear Station in the EIS, which includes a 93-month construction schedule and a peak workforce of 4,613 workers. The NRC concluded that beneficial economic impacts would be MODERATE in Cherokee County and SMALL elsewhere. The in-migration of approximately 70 percent of the workforce would result in increased demand for housing, recreation, and infrastructure and community services, which could lead to adverse socioeconomic impacts. The NRC concluded that adverse socioeconomic impacts would be SMALL for the region. (NRC 2013f, Sections 4.4.2, 4.4.3, and 4.4.4)

The NRC considered the socioeconomic impacts from operation of W.S. Lee Nuclear Station with a workforce of 957 persons, which includes regular full-time employees and contingent workers, at an in-migration rate of 36 percent. The NRC concluded that beneficial economic impacts from the workforce would be moderate in Cherokee County, but the fee-in-lieu payments to Cherokee County would increase the overall beneficial impact to LARGE. The beneficial economic impacts would be SMALL elsewhere. The in-migration and increased population would result SMALL adverse socioeconomic impacts across the region. (NRC 2013f, Sections 5.4.3 and 5.4.4)

Regarding the socioeconomic impacts of the SMR facility at ONS, the workforce size and tax payments were considered. Because the SMR reactors would not require substantial onsite construction as do ALWRs, the size of the construction workforce and duration of construction would be less than that of the W.S. Lee Nuclear Station. The level of construction activity would be further reduced by the use of existing infrastructure to the ONS site. Therefore, the

construction workforce would be more similar to that of the NGCC plant than of the W.S. Lee Nuclear Station. The socioeconomic impacts of construction of the NGCC plant are valid for the SMR facility and are described in Section 7.2.3.1.9.

The workforce for the 800-MWe Clinch River SMR facility was estimated at 500 workers (NRC 2018, Table 3-5). A review of the economics of SMR facilities estimated the operational workforce at 500 for a 1,000-MWe facility (SMR Start 2017). Therefore, the 427-MWe SMR facility would likely require fewer than 500 workers. ONS currently has a regular full-time workforce of 699 (Table 2.5-1). It is assumed that the current workforce could be used to supply the SMR workforce, which negates the need for the in-migration of workers. Some economic loss would be expected in communities where ONS employees live and shop because fewer workers would be employed at the SMR facility.

Duke Energy pays property taxes to Oconee County and is not subject to other forms of agreed-to payments, including payments in lieu of taxes. Duke Energy would continue to be assessed property taxes for the site and on the basis of use of the site as industrial property. Thus, Duke Energy would be expected to pay similar tax amounts as under current conditions. The Duke Energy property tax payments are approximately 73 percent of the FY 2019 total property tax revenues of Oconee County (Section 3.9.5). The socioeconomic impact from taxes would be a significant benefit to Oconee County.

The socioeconomic impacts resulting from the operation of the SMR facility would be MODERATE and beneficial but less than the current socioeconomic impact of ONS because fewer workers would be employed at the SMR facility.

Transportation

The NRC considered the transportation impacts from construction of W.S. Lee Nuclear Station and concluded that the temporary impacts of construction on transportation in the region would be SMALL but MODERATE within the 6-mile vicinity. This assessment was based on the peak workforce split into two shifts, a 1.4-person vehicle occupancy, and implementation of planned upgrades and improvements to the road systems. (NRC 2013f, Section 4.4.4.1)

Traffic-related impacts would be reduced after construction of W.S. Lee Nuclear Station. Transportation impacts would result from the approximately 957 workers, equipment and materials deliveries, and truck traffic, with increased traffic during outages. Duke Energy would operate staggered shifts, comparable to other nuclear facilities. Therefore, operations-related transportation impacts would be SMALL. (NRC 2013f, Sections 5.4.4 and 5.4.4.1)

The construction workforce and level of construction activities for the SMR facility would be similar to that of the NGCC plant. The transportation impacts of construction of the NGCC plant are valid for the SMR facility and are described in Section 7.2.3.1.9. The SMR operations workforce would be smaller than the current ONS operations workforce and would be a SMALL impact to local roadways already handling the current larger workforce.

7.2.3.2.10 Human Health

Impacts on human health from construction of W.S. Lee Nuclear Station would be similar to those associated with a large industrial facility construction project. Compliance with OSHA worker protection rules would prevent safety-related accidents. The NRC evaluated nonradiological impacts on public and construction worker health from fugitive dust, occupational injuries, noise, and transport of materials and personnel to and from the W.S. Lee Nuclear Station site. No significant impacts related to the nonradiological health of the public or workers were identified. The NRC concluded that the nonradiological health impacts of construction and preconstruction activities associated with the proposed Units 1 and 2 would be SMALL. (NRC 2013f, Section 4.8.4)

After fuel for the proposed Unit 1 is moved onsite and the reactor is fueled and put into operation, the potential sources of radiation exposure for construction workers on proposed Unit 2 would include direct radiation exposure, exposure from liquid effluents, and exposure from gaseous radioactive effluents from operation of proposed Unit 1. The NRC concluded that the estimate of doses to construction workers during construction of the proposed Units 1 and 2 are well within NRC annual exposure limits designed to protect the public health and radiological health impacts on construction workers engaged in building activities related to the Units 1 and 2 would be SMALL. (NRC 2013f, Sections 4.9 and 4.9.5)

Human health impacts associated with the construction of an SMR facility at ONS would primarily be associated with potential accidents. Worker safety would be addressed by adherence to OSHA worker protection and other initiatives such as the contractor safety meetings. The radiological human health impact on construction workers due to working in proximity to ONS would be SMALL due to compliance with NRC regulations and adherence to ALARA principles.

Occupational injuries in the nuclear power industry are historically below the average U.S. industrial rate. Health effects to the public and workers from thermophilic microorganisms and noise generated by operations would be minimal. The NRC evaluated the potential health impacts from routine gaseous and liquid radiological effluent releases from W.S. Lee Nuclear Station and concluded that there would be no observable health impacts to the public from normal operation of the units. Occupational radiation exposure at the W.S. Lee Nuclear Station site would be maintained within 10 CFR 20.1201 limits and collective occupational doses being typical of doses found in current operating light water reactors. Therefore, the NRC concluded that any health impacts from operations would be SMALL. (NRC 2013f, Sections 5.8.7, 5.9.3.3, and 5.9.4)

Duke Energy would adhere to OSHA safety standards and comply with EPA and NRC exposure limits for the public and workers for operation of the SMR facility. Therefore, like the operations of W.S. Lee Nuclear Station, the SMR facility operations would pose SMALL impacts to human health.

7.2.3.2.11 Environmental Justice

The NRC evaluated the potential environmental justice impacts associated with W.S. Lee Nuclear Station to minority and low-income populations within the vicinity and region. The NRC determined there are no environmental, health, or socioeconomic pathways by which the identified minority or low-income populations in the 50-mile region would be likely to suffer disproportionately high and adverse environmental or health impacts as a result of construction and preconstruction activities. Overall, the construction and operation of W.S. Lee Nuclear Station would not result in disproportionately high and adverse human health and environmental effects on minority and low-income population residing in the region. In its final EIS, the NRC concluded that environmental justice impacts would be SMALL. (NRC 2013f, Sections 4.5.5 and 5.5.5)

Given the same location and the same construction activities, SCDHEC permits for stormwater and air emissions, BMPs, and implementation of SWPPPs and SPCC plans, the environmental justice assessment for the NGCC plant is considered to be applicable to the SMR facility and is described in Section 7.2.3.1.11. Therefore, no disproportionately high and adverse effects to low-income and minority populations are expected from the construction of the SMR facility.

No disproportionately high and adverse effects to low-income and minority populations are associated with SMR facility operations. This conclusion is based on no change in the severity of operations impacts associated with the SMR option versus ONS, as described in Section 4.10.

7.2.3.2.12 Waste Management

Solid, liquid, and gaseous wastes generated during the construction of the proposed W.S. Lee Nuclear Station Units 1 and 2 would be handled according to county, state, and federal regulations. County and state permits, regulations for handling and disposal of solid waste, and USACE permits for disposal of dredged spoils would be obtained and implemented. The NRC concluded that nonradiological waste impacts on land, water, and air during construction and preconstruction activities would be SMALL (NRC 2013f, Section 4.10.4)

Construction of an SMR facility at ONS would generate waste types and volumes similar to those of associated with the construction of the NGCC alternative. The wastes generated would be handled according to county, state, and federal regulations and disposed at approved offsite treatment or disposal facilities. Therefore, construction-related waste impacts would be SMALL.

During operations, the two components of the nuclear alternative would generate nonhazardous, hazardous, spent nuclear fuel, and radioactive waste. The nonhazardous and hazardous waste would be managed in compliance with state regulations and disposed of in permitted facilities. Duke Energy would implement recycling and waste minimization programs that would reduce waste volumes. The NRC concluded nonradiological waste impacts from operations at W.S. Lee Nuclear Station would be SMALL given Duke Energy's compliance with permits and regulatory approvals, as well as implementation of effective practices for recycling,

minimizing, managing, and waste disposal (NRC 2013f, Section 5.10.5). This conclusion is valid for the SMR option as well. Radioactive waste would be managed onsite, transported, and disposed of in permitted facilities in accordance with NRC, U.S. Department of Transportation, and state regulations. Spent nuclear fuel would be managed onsite in accordance with NRC regulations until transported offsite to an interim or permanent storage facility. Therefore, environmental impacts associated with radioactive waste would be SMALL.

7.2.3.3 Combination of Alternatives

The combination of alternatives involves the construction and operation of an NGCC plant and solar PV facility and implementation of demand side management programs. This combination of alternatives would provide the following generation:

- A 2,749-MWe (gross) NGCC plant located at ONS that provides approximately 2,392 MWe net.
- Five 70-MWe solar PV facilities at five offsite locations coupled with battery storage to provide 120 MWe (net) total baseload energy.
- Two 90-MWe onshore wind installations located in central North Carolina or central South Carolina providing an estimated 28 MWe net.
- Implementation of DSM programs equal to savings of 50 MWe (net).

As presented in Section 7.2.1.1, the NGCC plant would be sited on the ONS site and adjacent Duke Energy-owned property. Approximately 119 acres of land would be required to construct the facility.

Each solar PV facility would be sited on approximately 450 acres of land based on 60-80 MWe requiring 400 to 500 acres based on Duke Energy's solar siting experience. A site would be selected based on sufficient transmission infrastructure and avoidance of sensitive resources, including cultural resources, wetlands, and threatened and endangered species habitat. Duke Energy also assumes that the sites have been previously disturbed from industrial or other commercial development or agricultural use. These facilities would not require cooling systems.

Wind turbines are spaced for operation, so wind farms encompass many acres between the linked turbines. This acreage typically continues to be used for farmland and other compatible purposes. Each wind installation would range from about 20 to 50 turbines (2-MW to 4-MW size turbines) scattered in across a large land area with installation of each turbine disturbing about 5 acres of land (see Section 7.2.3.3.1).

The DSM component of the combination alternative would consist of Duke Energy's energy efficiency programs that would provide reduction in the use of electricity equivalent to 50 MWe of generation.

Environmental impacts associated with the combination alternative are described below.

7.2.3.3.1 Land Use

The impact on land use due to construction and operation of the NGCC plant and associated pipeline connection would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.1 and would be SMALL to MODERATE.

Utility-scale solar facilities use relatively large areas of land to generate electricity. Approximately five sites of 450 acres each would be required to install 350 MWe of solar PV. Depending on the selected location, a solar facility may impact existing land use. Land-use impacts can be minimized by siting the facilities on industrial and commercial land or other land with compatible use. Overall, because of the large land area requirements, solar impacts on land use would be MODERATE.

DOE developed land use metrics for wind generation of 2.47 acres per MW for disturbed area. A further breakdown of this disturbed area is 0.74 acres per MW hosting permanent structures and supporting facilities such as transformers and access roads and 1.73 acres per MW for temporary land use to support construction (DOE 2015). Wind turbines are spaced for operation, so the wind farm encompasses many acres between the linked turbines. This acreage typically continues to be used for farmland and other compatible purposes. Based on these metrics a 90-MW wind facility would have a construction footprint of 222 acres and a permanent footprint of 67 acres. Wind turbines are spaced for operation, so the wind farm encompasses many acres between the linked turbines. This acreage typically continues to be used for farmland and other compatible purposes. Wind farm boundaries encompassed approximately 85.24 acres per MW based on a 2009 study (DOE 2015). Using this metric, a 90-MW wind farm would encompass 7,672 acres. For comparison, the coastal wind farm in Elizabeth City, NC, of 104 wind turbines (208 MW total) is sited on approximately 22,000 acres leased from more than 60 local landowners (Elizabeth City 2020). Depending on the selected location, a wind farm may impact existing land use; however, as stated above wind turbines are compatible with many land use categories and can be co-located and not require a conversion of land use other than the turbine's footprint. However, the number of land parcels and landowners that are often required to site a wind farm provides uncertainty with impacts to land use. Therefore, land use impacts would be from SMALL to MODERATE.

DSM would not have a direct effect on land use; however, increased turnover of older appliances for more energy efficient units may result in a minor increase in landfill space use and recycling. This minimal increase in disposal of appliances is normal and would result in a SMALL land use impact.

Overall, the land use impacts from the construction and operation of the combination alternative would range from SMALL to MODERATE.

7.2.3.3.2 Visual Resources

Visual impacts from the NGCC plant component of the combination alternative would be essentially the same as those described for the discrete NGCC alternative in Section 7.2.3.1.2.

The solar facilities would require large land areas. The solar PV panels could be visible to the public from offsite locations, depending on buffer areas or screening. The solar PV facilities would be sited to comply with land zoning and any required buffers or screening.

The wind turbines of each wind farm would be visible from all directions and could be a large impact on the viewscape depending on the site selection. In line with Duke Energy's IRP, the location of the wind farms is assumed to be central North Carolina or central South Carolina, which avoids scenic mountain areas. Site selection would seek to minimize visual impacts and site selection would avoid impacting scenic areas such as U.S. Congress-designated areas for protection of unique natural, cultural, and recreational values (e.g., national scenic and historic trails, national historic landmarks, scenic areas, recreation areas, preserves, and monuments). Avoiding impacts on the most scenic viewscapes would reduce the most significant visual impacts, allowing the impact to be noticeable but not destabilizing.

The turbines would be marked and lighted according to Federal Aviation Administration (FAA) guidelines, which call for painting the turbines and towers white or light gray, while making them highly visible to pilots from the air. Synchronized flashing red aviation lights would be mounted atop selected turbines and at the end of each turbine string or within and around the perimeter such that the gap between lights is no greater than 0.5 miles, allowing the entire facility to be perceived as a single unit by pilots flying at night. The specific location of aviation lighting and the operation of the lighting system would be determined in consultation with FAA. (FAA 2015)

Overall, the visual impacts from the construction and operation of the combination alternative would range from SMALL to MODERATE.

7.2.3.3.3 Air Quality

The impacts on air quality due to construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.3 and would be SMALL for construction related impacts and MODERATE for operational impacts.

Construction activities associated with the solar PV and wind installations would generate fugitive dust. Mitigation would be implemented via wetting of cleared areas and dirt roads to minimize the fugitive dust. Construction equipment and vehicles would also emit exhaust emissions. These emissions would be temporary and mitigation such as curtailing idling of vehicles would be implemented to minimize short-term air quality impacts. Construction emissions associated with the solar component of the combination alternative would be SMALL. The solar and wind components of the combination alternative would not release any air emissions during operation.

Overall, the air quality impacts from the construction of the combination alternative would be SMALL and operations would be MODERATE for the NGCC component.

7.2.3.3.4 Noise

The construction and operation of the NGCC plant component of the combination alternative would have noise impacts similar to those described in the discrete NGCC plant alternative presented in Section 7.2.3.1.4 and would be SMALL.

Construction of each solar PV and wind installation would likewise have noise impacts similar to those described in the discrete NGCC plant alternative presented in Section 7.2.3.1.4 with a shorter duration. No noise impacts would occur from operation of the solar PV facility.

However, given the acreage of the solar installations and the potential need for land clearing and the number of turbines that would need to be installed, noise impacts would range from SMALL to MODERATE and be temporary for the duration of construction of each facility.

During operations, the wind turbines would emit sound. Turbine sound is typically one of the greatest nuisance impacts associated with wind power. The DOE addressed this concern with a review of the available data and research on impacts to human health, concluding that as of 2013, global peer-reviewed scientific data and independent studies consistently concluded that sound from wind plants has no direct impact on physical human health. (DOE 2015)

Overall, construction noise impacts associated with combination alternative would be SMALL to MODERATE. Operations-related noise impacts associated with the combination alternative would be SMALL.

7.2.3.3.5 Geology and Soils

The impact on geology and soils due to construction and operation of the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.5 and would be SMALL.

Construction impacts to geology and soils resulting from the construction of the solar PV and wind facilities would primarily be impacts to soils from clearing and grubbing. These temporary soil impacts would be minimized by implementation of BMPs identified in the SWPPP. Geological impacts would be minor, as any gravel or stone used in the construction of roads and infrastructure would be sourced from local businesses that sell materials sourced from local quarries. During operations, the solar PV and wind facilities would be required to comply with state regulations that regulate stormwater runoff. If stormwater is an issue at the facilities, BMPs would be installed to minimize the impact of erosion and runoff from these sites. Therefore, construction and operational impacts on geology and soils from the solar component of the combination alternative would be SMALL.

Overall, the geology and soils impacts from the construction and operation of the combination alternative would be SMALL.

7.2.3.3.6 Hydrology (Surface Water and Groundwater)

The impact on surface water use and quality due to constructing and operating the NGCC plant component would be similar to that associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.6 and would be SMALL.

Duke Energy assumes water used for construction of the solar and wind facilities will be used for dust suppression, equipment washing, and sanitary systems, and that potable water will be trucked in by the construction contractor. Water quality impacts could result from erosion and runoff associated with the construction of the solar facilities. These temporary soil impacts would be minimized by implementation of BMPs identified in the SWPPP. Once in operation, Duke Energy would operate the facilities in compliance with stormwater regulations. The surface water use and water quality impacts associated with the construction and operation of the solar PV facility would be SMALL.

Therefore, the impact on surface water use and quality due to constructing and operating the combination alternative would be SMALL.

Groundwater

The impact on groundwater use and quality due to constructing the NGCC plant component of the combination alternative would be similar to that associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.6 and would be SMALL.

A well could be installed to provide groundwater for use during construction and operations at solar and wind facility sites where municipal water is not available. Wells would be installed in accordance with state and local regulations and Duke Energy would comply with any groundwater use limits. Groundwater would be protected through the implementation of SWPPP and spill prevention measures.

The impacts to groundwater from the combination alternative would be SMALL.

7.2.3.3.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial

The impact on terrestrial resources due to construction and operation of the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.7 and would be SMALL.

Terrestrial ecology impacts resulting from the construction of five solar PV facilities would result from the 450 acres of land development required for each of the facilities. This development could occur at five separate sites and would avoid wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. Therefore, terrestrial ecology impacts associated with the solar PV component of the combination alternative would be SMALL to MODERATE given the large land

requirement. No operational impacts to terrestrial ecological resources would occur from the solar PV component of the combination alternative.

The site selection process that would be used to select sites for the wind farms would have criteria to avoid wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. Duke Energy would also follow USFWS guidance for land-based wind energy development and eagle conservation. The guidance focuses on "species of concern" and addresses loss and degradation/fragmentation of habitat.

The operation of the wind turbines could affect avian and bat species. Following USFWS and guidance for siting would minimize impacts and compliance with any incidental take permits would minimize impacts to special status species. As discussed in DOE's 2015 *Wind Vision*, mortality rates for birds at land-based wind plants average between three and five birds per MW per year, and no plant has reported an average greater than 14 birds per MW per year with common songbirds accounting for approximately 60 percent of all bird collision mortality. Those mortality levels for the 61 gigawatt of wind capacity installed in 2013 at the time of DOE's study constitute a very small percentage, typically <0.02 percent, of the total populations of those songbird species. (DOE 2015) Using the annual average of five bird deaths per MW, operation of each wind farm would result in an estimated 450 bird deaths per year of operation.

Overall, the ecological impacts to terrestrial species from the construction and operation of the combination alternative would be SMALL to MODERATE.

Aquatic

The impact on aquatic resources due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.7 and would be SMALL.

No impacts to aquatic resources would result from the construction of the solar PV and wind components of the combination alternative due to the implementation of BMPs to control erosion and run-off. No operations-related impacts are associated with the solar PV and wind components of the combination alternative.

Therefore, the ecological impacts to aquatic species from the construction and operation of the combination alternative would be SMALL.

Special Status Species

The impact on special status species due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.7 and would be NO EFFECT.

The site selection process that would be used to select sites for the solar and wind facilities would have criteria to avoid locations whose development would impact special status species.

As discussed above, Duke Energy would also follow USFWS guidance for land-based wind energy development focused on "species of concern" and eagle conservation. For selected sites, Duke Energy would also follow USFWS guidance for tree removal for protecting special status species and minimize tree removal to the extent practicable. If tree removal is necessary, the construction would either clear outside of the northern long-eared bat and affected migratory birds of concern roosting and nesting seasons and follow USFWS guidelines regarding acceptable dates for clearing or conduct appropriate surveys prior to construction to avoid impacts to active roosts or nests. To protect the northern long-eared bat, the USFWS 4(d) Rule restricts tree removal within 0.25 mile of a known hibernaculum and within a 150-foot radius of a known occupied maternity roost tree during June and July (USFWS 2019h). To avoid take of the bald eagle, timber harvesting operations would avoid clear-cutting within 330 feet of active or inactive nests at any time and avoid encroaching within 660 feet of an active nest during nesting season (USFWS 2019i).

Given avoidance, minimization and mitigation measures, and compliance with applicable permits, each solar and wind installation MAY AFFECT, but is NOT LIKELY TO ADVERSELY AFFECT special status species during the construction and operation of the combination alternative.

7.2.3.3.8 Historic and Cultural Resources

The impact on historic and cultural resources due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.8 and would be ADVERSE EFFECT.

The site selection process that would be used for the solar and wind facilities would have criteria to avoid locations whose development would impact cultural resources. With application of the site selection process, impacts to historic and cultural resources from constructing and operating the solar PV and wind facilities would be NO EFFECT.

Cultural resources, both historic and archaeological, will be avoided or protected during the construction and operation of the facilities under the combination alternative through the siting and consultation process. However, given the adjacent existing NRHP site is the impact to cultural resources is conservatively determined to result in ADVERSE EFFECT.

7.2.3.3.9 Socioeconomics

Socioeconomic Issues Other than Transportation

The construction and operation of the NGCC component of combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.9 and would range from SMALL for construction to MODERATE beneficial for operation.

The construction and operation of the solar PV and wind components of the combination alternative would create fewer construction jobs than the NGCC plant. The jobs created to complete the construction would be temporary jobs. It is expected some of the workers

associated with the construction activity may relocate to the area temporarily during the construction of these facilities. However, most of these workers would return to their permanent places of residence at the completion of the construction. Therefore, any boost to the local economies would be short in duration, and socioeconomic impacts related to the construction of combination alternative would be SMALL.

The number of workers required to maintain each solar PV and wind facility would be small, and it would not result in a quantifiable impact on the local economy. If Duke Energy leased the property for the wind farms, lease payments would be made the to property owners. The solar PV installations and the property occupied by the wind turbines could also be taxed could be taxed at a higher rate than agricultural or forest land, providing a tax benefit. The beneficial impact would be dependent on the tax base of the county but given that each installation does not occupy very large acreages the impact would likely be small. Therefore, the operations-related socioeconomic impacts under the solar PV and wind components of combination alternative would be SMALL.

DSM programs such as energy efficiency initiatives could result in a need for more workers to install windows, appliances, insulation, and other building components to reduce energy use. The workers involved in these programs would stimulate the local economy through purchases of goods and services. Any socioeconomic stimulus from energy efficiency programs would be minimal and the result would be a SMALL socioeconomic impact.

Overall, the socioeconomic impacts from the construction and operation of the combination alternative would be SMALL for each PV site and the NGCC component would range from SMALL for construction and MODERATE beneficial for operations.

Transportation

Transportation impacts during the construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.9 and would be MODERATE during construction and SMALL during operation.

Transportation impacts during the construction of the solar PV and wind components of the combination alternative would be less than the impacts for any of the other alternatives presented. The construction workforce and equipment transported to the individual sites would be less than the amount required for the other alternatives. Traffic impacts associated with the operation of each solar PV and wind facility would not be quantifiable. Once the facility is in operation, very few employees would be required for facility operations. Therefore, transportation impacts for construction and operation under the solar PV and wind components of the combination alternative would be SMALL.

Overall, the transportation impacts associated with construction and operation of the combination alternative would be SMALL for the solar and wind components and range from SMALL to MODERATE for the NGCC component.

7.2.3.3.10 Human Health

Impacts on human health from construction and operation of the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.10 and would be SMALL.

During construction of the solar PV and wind facilities, worker safety would be addressed by following the OSHA worker protection standards. Therefore, construction-related impacts on human health under the solar PV and wind components of the combination alternative would be SMALL. As noted in Section 7.2.3.3.4, DOE concluded regarding wind turbine noise that sound from wind plants has no direct impact on physical human health. (DOE 2015)

Therefore, the human health impacts associated with the construction and operation of the combination alternative would be SMALL.

7.2.3.3.11 Environmental Justice

Potential impacts on minority and low-income populations from construction and operation of the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative discussed in Section 7.2.3.1.12.

Potential impacts on minority and low-income populations from the construction of solar PV and wind components of the combination alternative would primarily result from socioeconomic effects. Some minor environmental impacts would result from fugitive dust during construction , but this impact would be temporary and short in duration. Socioeconomic impacts on minority and low-income population under the combination alternative would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the projects. The temporary increase in traffic on roads would likely result in some small impacts to traffic that could affect local minority and low-income populations.

Overall, the construction and operations of the solar PV and wind components of the combination alternative would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

DSM programs, such as energy efficiency targeted for low-income populations, could have a minor positive effect on the households that participate in the programs. These programs could also result in employment opportunities for low-income and minority populations. Overall, DSM programs, especially those targeted for low-income communities, would not have a disproportionately high and adverse effect on low-income and minority populations.

Overall, the construction and operations of the combination alternative would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

7.2.3.3.12 Waste Management

Impacts on waste management from construction and operation of the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section 7.2.3.1.12 and would be SMALL.

The construction of the solar PV and wind facilities component of the combination alternative would create sanitary and industrial waste, although it would be in smaller quantities compared to the NGCC plant. This waste will be recycled, disposed of onsite, or shipped to an offsite waste disposal facility. The operation of each solar PV and wind facility is expected to generate very minimal waste. All waste generated at the facility will be recycled or disposed of at an offsite waste disposal facility. Therefore, waste management impacts from the solar PV and wind facilities would be SMALL.

DSM could have some effect on local waste management programs because of the disposal of older appliances and housing materials. These materials would either be disposed of in landfills or recycling centers. The disposal of these items is expected to be minimal and similar to what would occur with the turnover of appliances that require replacement. Therefore, DSM impacts to waste management would be SMALL.

Overall, the waste management impacts from the construction and operation of the combination alternative would be SMALL.

Table 7.2-1 Air Emissions from NGCC Plant Alternatives

Emission	Discrete Alternative (annual amount)	Combination Alternative (annual amount)
Gas consumption	195 billion ft^3	178 billion ft^3
Sulfur dioxide	343 tons	313 tons
Nitrogen oxides[(a)]	1,310 tons	1,197 tons
Carbon monoxide	3,020 tons	2,763 tons
Particulate matter	665 tons	608 tons
Nitrous oxide	302 tons	276 tons
Volatile organic compounds	212 tons	193 tons
Carbon dioxide	11.1 million tons	10.1 million tons

a. Assumes 90 percent reduction in emissions due to operation of air pollution control equipment (selective catalytic reduction).

Formulas and Sources

Annual gas consumption (ft^3)	Plant size in MWe x heat rate, 7,649 Btu/kWh x 1,000 x (1/ heat content = 1,033 Btu/ft^3) x hours in a year

Heat content of natural gas 2018 = 1,033 Btu/ft^3 (EIA 2018)

Heat rate = 7,649 Btu/kWh (EIA 2019c)

Annual MMBtu = (annual gas consumption x fuel heating average value)/1,000,000

Emission factor for processed natural gas (lbs/MMBtu)	CO_2	NO_X	CO	PM	SO_2	VOC	N_2O
	110	0.13	0.03	0.0066	0.0034	.0.0021	0.003

Annual emissions (tons) = (emission factor) x (annual MMBtu)/2000

Air emission factors (EPA 2000, Tables 3.1-1 and 3.1-2a)

CO_2 = carbon dioxide; NO_x = nitrogen oxides; CO = carbon monoxide; PM = total filterable particulates; SO_x = oxides of sulfur; VOC = volatile organic carbon; NO_2 = nitrous oxide.

Table 7.2-2 Annual Estimated Emissions of NGCC Alternative

Emission	Based on EPA AP-42 Emission Factors[b]	Based on emission estimates for Citrus Combined Cycle Project[c]
Sulfur dioxide	343 tons	497 tons
Nitrogen oxides[a]	1,310 tons	498 tons
Carbon monoxide	3,020 tons	1,150 tons
Particulate matter	665 tons	598 tons
Volatile organic compounds	212 tons	125 tons
Carbon dioxide	11.1 million tons	10.3 million tons

a. Assumes 90 percent reduction in emissions due to operation of air pollution control equipment (selective catalytic reduction).

b. (EPA 2000)

c. (Duke 2014b)

7.3 Alternatives for Reducing Adverse Impacts

7.3.1 Alternatives Considered

As noted in 10 C51.53(c)(3)(iii), "The report must contain a consideration of alternatives for reducing adverse impacts, as required by 51.45(c), for all Category 2 license renewal issues in Appendix B to Subpart A of this part." A review of the environmental impacts associated with the Category 2 issues in Chapter 4 identified no significant adverse effects that would require consideration of additional alternatives. Therefore, Duke Energy concludes that the impacts associated with renewal of the ONS ROLs would not require consideration of alternatives for reducing adverse impacts as specified in NRC Regulatory Guide 4.2, Revision 1 (NRC 2013f, Section 7.2). This determination assumes the existing mitigation measures discussed in Section 6.2 adequately minimize and avoid environmental impacts associated with operating ONS.

7.3.2 Environmental Impacts of Alternatives for Reducing Adverse Impacts

No additional alternatives were considered by Duke Energy to reduce impacts because as determined in Chapter 4, the continued operation of ONS does not result in significant adverse effects to the environment.

8.0 COMPARISON OF THE ENVIRONMENTAL IMPACT OF SUBSEQUENT LICENSE RENEWAL WITH THE ALTERNATIVES

To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form . . . . [10 CFR 51.45(b)(3)]

The proposed action is to renew for a second time the ONS Units 1, 2, and 3 OLs, which would preserve the option for Duke Energy to continue operating ONS and provide reliable baseload power for the 20-year proposed SLR operating term. Chapter 4 analyzes the environmental impacts of the proposed action. The proposed action is compared to the no-action alternative, which includes both the termination of operations and decommissioning of ONS and replacement of its baseload generating capacity. The termination of operations and decommissioning impacts are presented in the GEIS (NRC 2013a), Section 14.2.2, and decommissioning impacts are analyzed in the GEIS on decommissioning, NUREG-0586, Supplement 1 (NRC 2002). The energy alternatives component of the no-action alternative is described and its impacts analyzed in Chapter 7.

Table 8.0-1 summarizes the environmental impacts of the proposed action and the alternatives deemed reasonable for comparison purposes. Table 8.0-2 summarizes the locations and plant features used in the analysis of the energy alternatives. Table 8.0-3 provides a more detailed comparison of environmental impacts. The environmental impacts compared in Tables 8.0-1 and 8.0-3 are Category 1 and 2 issues that apply to the proposed action or issues that the GEIS identified as major considerations in an alternatives analysis.

As shown in Tables 8.0-1, 8.0-2, and 8.0-3, there is no reasonable alternative superior to that of the continued operation of ONS. The continued operation of ONS would create significantly fewer environmental impacts than the construction and operation of new alternative generating capacity. In addition, the continued operation of ONS will have a significant positive economic impact on Oconee County through tax payments by Duke Energy for ONS. Continued employment of plant workers will continue to provide economic benefits to the communities surrounding the station.

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 1 of 3)

Impact Area	Proposed Action	No-Action Alternative				
		Termination of Operations and Decommissioning	NGCC Plant Alternative and NGCC Component of Combination of Alternatives	New Nuclear Plant Alternative		Solar and Onshore Wind Components of Combination of Alternatives[(a)]
				ALWR Component	SMR Component	
Land Use	SMALL	SMALL	SMALL (plant) MODERATE (natural gas pipeline connection)	MODERATE	SMALL	MODERATE
Visual Resources	SMALL	SMALL	SMALL	MODERATE	SMALL	SMALL to LARGE
Air Quality	SMALL	SMALL	Construction: SMALL Operations: MODERATE	SMALL	SMALL	Construction: SMALL Operations: None
Noise	SMALL	SMALL	SMALL	SMALL	SMALL	Construction: SMALL to MODERATE Operations: SMALL
Geology and Soils	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Terrestrial	SMALL	SMALL	SMALL	Construction: MODERATE Operations: SMALL	SMALL	Construction: SMALL to MODERATE Operation: SMALL
Aquatic	SMALL	SMALL	SMALL	Construction: MODERATE Operation: SMALL	SMALL	None

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 2 of 3)

Impact Area	Proposed Action	No-Action Alternative				
		Termination of Operations and Decommissioning	NGCC Plant Alternative and NGCC Component of Combination of Alternatives	New Nuclear Plant Alternative		Solar and Onshore Wind Components of Combination of Alternatives[a]
				ALWR Component	SMR Component	
Special Status Species	NO EFFECT	[b]	Construction: NO EFFECT (plant) NOT LIKELY to ADVERSELY AFFECT (pipeline)	NOT LIKELY TO ADVERSELY AFFECT	NO EFFECT	NOT LIKELY to ADVERSELY AFFECT
Historic and Cultural	NO ADVERSE EFFECT	NO ADVERSE EFFECT	ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT
Socioeconomics	SMALL (adverse) ONS provides significant beneficial economic impacts through tax payments (Section 3.9.5)	Termination: MODERATE to LARGE (adverse); Decommissioning: SMALL (adverse)	Construction: SMALL (adverse) and SMALL (beneficial Operations: SMALL (adverse) and MODERATE (beneficial	Construction: SMALL (adverse) and MODERATE (beneficial) Operations: SMALL (adverse) and LARGE (beneficial	Construction: SMALL to MODERATE (adverse) and MODERATE (beneficial) Operations: SMALL (adverse) MODERATE (beneficial	Construction: SMALL (adverse) SMALL (beneficial) Operation: SMALL (beneficial)
Transportation	SMALL	SMALL	Construction: MODERATE Operations: SMALL	Construction: MODERATE Operations: SMALL	Construction: SMALL to MODERATE Operations: SMALL	SMALL
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL	Construction: SMALL Operations: SMALL

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 3 of 3)

Impact Area	Proposed Action	No-Action Alternative				
		Termination of Operations and Decommissioning	NGCC Plant Alternative and NGCC Component of Combination of Alternatives	New Nuclear Plant Alternative		Solar and Onshore Wind Components of Combination of Alternatives[a]
				ALWR Component	SMR Component	
Environmental Justice	No disproportionately high and adverse effects	(b)	No disproportionately high and adverse effects	No disproportionately high and adverse effects	No disproportionately high and adverse effects	No disproportionately high and adverse effects
Waste Management	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

a. The combination of alternatives includes NGCC, solar, onshore wind, and demand-side management components. The impacts of the demand-side management component are a SMALL impact to waste management due to a minimal increase in disposal of appliances and a minimal beneficial socioeconomic impact due to purchase of and installation labor for energy efficient building materials and appliances.

b. NUREG-0586 Supplement 1 (NRC 2002), the decommissioning GEIS, identifies this resource area as requiring a site-specific analysis based on site conditions at the time of decommissioning, as well as the proposed decommissioning method and activities. Decommissioning ONS would at the soonest occur after the expiration of the current license term. The magnitude of impacts could vary widely based on site-specific conditions at the time and analysis of special status species and/or their habitat(s), a consideration of their presence or the presence of their habitats, and environmental justice analysis, the potential for disproportionately high and adverse impacts from the impacts of decommissioning being experienced by minority or low-income populations as determined by the most recent USCB decennial census data when the alternative is implemented. Thus, Duke Energy cannot forecast a level of impact for this resource area.

Table 8.0-2 Alternatives Features Comparison Summary (Sheet 1 of 2)

Feature	NGCC Alternative	New Nuclear Alternative		Combination Alternative
		ALWR Component	SMR Component	
Summary of Alternative	Multiple combustion turbines assembled in appropriate power train configurations for a total of 3,009 MWe design capacity. (Section 7.2.1.1)	Two-unit nuclear plant (proposed W.S. Lee Nuclear Station) for a total of 2,234 net MWe. (Section 7.2.3.2)	Cluster of SMR units with design capacity of 427 MW (Section 7.2.3.2)	One NGCC plant of 2,749 gross MWe; five 70-MWe solar PV facilities coupled with battery to provide 120 MW total baseline energy, two 90-MWe onshore wind installations, DSM program for 50 MW net savings (Section 7.2.3.3)
Location	At existing Duke Energy ONS site and adjacent Duke Energy-owned property. (Section 7.2.3.1.1)	W.S. Lee Nuclear Station site in Cherokee County, SC (Section 7.2.3.2.1)	ONS site (Section 7.2.3.2.1)	NGCC: At existing Duke Energy ONS site. (Section 7.2.3.3) Solar PV: Locations determined via site selection process at sites in close proximity to transmission lines. (Section 7.2.3.3.1) Onshore wind: Locations in central North or South Carolina determined via site selection process at sites in close proximity to transmission lines. (Section 7.2.3.3)
Cooling System	Closed-cycle cooling with mechanical draft cooling towers using ONS intake and discharge structures with needed modifications. (Section 7.2.1.1)	Closed-cycle cooling system with mechanical draft cooling towers (Section 7.2.3.2)	Closed-cycle cooling with mechanical draft cooling towers using ONS intake and discharge structures with needed modifications (Section 7.2.3.2.6)	NGCC: Closed-cycle cooling with mechanical draft cooling towers using ONS intake and discharge structures with needed modifications. (Section 7.2.1.1) Solar PV and Wind: No cooling system required. (Section 7.2.3.3)

Table 8.0-2 Alternatives Features Comparison Summary (Sheet 2 of 2)

Feature	NGCC Alternative	New Nuclear Alternative		Combination Alternative
		ALWR Component	SMR Component	
Land Requirements	130 acres on existing ONS property and adjacent Duke Energy-owned property, new pipeline corridor from existing supply lines (21-28 miles distant) no additional gas fields required. (Section 7.2.3.1.1)	3,000+ acres for the plant, make-up water pond, and transmission lines (Section 7.2.3.2.1)	Less than 110 acres on existing ONS property (Section 7.2.3.2.1)	NGCC: 122 acres on existing ONS property, pipeline corridor from existing supply lines (21–28 miles distant), no additional gas fields required. (Section 7.2.3.1.1) Solar PV: five sites of 450 acres each (Section 7.2.3.3) Onshore Wind: Two sites of approximately 7,672 acres that encompass 66 acres occupied by turbines surrounded by compatible land use.
Workforce	Short-term increase in onsite workforce during peak construction; smaller workforce (150 workers) during operations. (Section 7.2.3.1.9)	4,613 workers during peak construction; 957 regular full-time employees during operations. (Section 7.2.3.2.9)	Short-term increase in onsite workforce during peak construction; less than 500 during operations (Section 7.2.3.2.9)	NGCC: Short-term increase in onsite workforce during peak construction; workforce similar to the proposed action during operations. (Section 7.2.3.1.9) Solar PV and Onshore Wind: Small short-term boost to local economies from construction. Permanent workforces would be small and not result in a quantifiable impact. (Section 7.2.3.3.9)

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 1 of 19)

Land Use		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Onsite land use Offsite land use
Termination of operations and decommissioning		**SMALL:** Temporary onsite land use changes during decommissioning are anticipated to be comparable to changes that occur during construction and operations and would not require additional land. Temporary changes in onsite land use would not change the fundamental use of the reactor site. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL** (plant): Constructed within the ONS site boundaries and on other Duke Energy-owned property (approximately 30 acres). The NGCC would not change the fundamental use of the site and the adjacent property would require a land use conversion, but given that it is adjacent, the land use change would be of SMALL impact. **MODERATE** (pipeline): Would require a new gas pipeline constructed in new utility corridors to connect to gas supply lines. Existing gas supply assumed adequate to support NGCC plant operations.
New nuclear plant alternative	**ALWR Component**	**MODERATE** (construction)**:** The W.S. Lee Nuclear Station would be sited on a site zoned industrial. The plant's water reservoir would require acquisition of approximately 2,110 acres of previously undisturbed rural land requiring long-term termination of agricultural and other rural land uses. Additional land would be affected by 31 miles of new transmission lines. **SMALL** (operations): Land uses at the W.S. Lee Nuclear Station would not change during plant operations.
	SMR Component	**SMALL**: Constructed within the ONS site boundaries and would not change the fundamental use of the site.
Combination of alternatives		**SMALL** (NGCC plant) and **MODERATE** (pipeline): The NGCC component is the same as for NGCC plant alternative above. **MODERATE** (solar PV): Would require large areas of land (five sites of 450 acres each); impact can be lessened during site selection by selecting industrial and commercial land or other land with compatible use. **SMALL to MODERATE** (onshore wind): Wind turbines occupying 66 acres within a larger (7,672 acres) boundary encompassing compatible land uses at two sites.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 2 of 19)

Visual Resources		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for aesthetic impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** Terminating nuclear power plant operations would not change the visual appearance of the nuclear power plant until demolition of structures. Decommissioning activities would be localized and reduced with implementation of BMPs. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL (plant):** Visible from SC-183, but not out of context with the developed site and the existing ONS facility. The additional clearing of trees will make the overall property more visible during the daylight hours. **SMALL (pipeline)**: Temporary and localized visual impacts during construction within existing corridors. New corridors would incur visual impacts from clearing the land, especially forested lands that would be converted to cleared right-of-way after installation of the pipeline. However, new corridors would undergo a selection process that includes avoidance of sensitive areas such as scenic areas, sensitive wildlife habitats, and cultural sites that could result in greater visual impacts.
New nuclear plant alternative	**ALWR Component**	**MODERATE:** The reactor domes would be visible from local and state parks in the surrounding area. Developing make-up pond C would involve clearing forested land, which could negatively affect the viewshed along SC 329 and residents in the vicinity of the make-up pond C site.
	SMR Component	**SMALL:** Construction and operations activities would appear similar to ONS industrial activities. Visible from Lake Keowee, but not out of context with the developed site and the existing ONS facility.
Combination of alternatives		**SMALL** (NGCC): The NGCC component is the same as for NGCC plant alternative above. **SMALL** (solar PV): PV panels could be visible to the public. Facilities would be sited to comply with land zoning and any required buffers or screening. **Up to LARGE** (onshore wind): Wind turbines would be visible from all directions and could be a large impact on the viewscape. Site selection would seek to minimize visual impacts and avoid impacting scenic areas.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 3 of 19)

Air Quality		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Air quality impacts (all plants) Air quality effects of transmission lines
Termination of operations and decommissioning		**SMALL:** After termination of operations, air emissions from the nuclear power plant would continue, but at greatly reduced levels. The most likely impact of decommissioning on air quality is degradation by fugitive dust. Use of BMPs, such as seeding and wetting, can be used to minimize fugitive dust. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL** (construction); **MODERATE** (operations): Construction impacts would be temporary. Emissions being maintained within state regulatory limits. Annual emission estimates during the operations period based on EPA emission factors are listed below; however, annual emissions based on a Duke Energy NGCC plant are lower with the exception of sulfur dioxide. Sulfur dioxide = 343 tons per year Nitrogen oxides = 1,310 tons per year Carbon monoxide = 3,020 tons per year Particulate matter = 665 tons per year Nitrous oxide = 302 tons per year Volatile organic compounds = 212 tons per year Carbon dioxide = 11.1 million tons per year
New nuclear plant alternative	**ALWR Component**	**SMALL:** Construction impacts would be temporary; operations impacts would be minor, and emissions being maintained within federal and state regulatory limits.
	SMR Component	**SMALL:** Construction impacts would be temporary; operations impacts would be minor, and emissions being maintained within federal and state regulatory limits.
Combination of alternatives		**SMALL** (construction); **MODERATE** (operations): Construction impacts would be temporary. Emissions being maintained within state regulatory limits. Annual emission estimates for the NGCC plant during the operations period based on EPA emission factors are listed below; however, annual emissions based on newly permitted Duke Energy NGCC plant are lower with the exception of sulfur dioxide. The solar and wind facilities would not release any air emissions during operation. Sulfur dioxide = 313 tons per year Nitrogen oxides = 1,197 tons per year Carbon monoxide = 2,763 tons per year Particulate matter = 608 tons per year Nitrous oxide = 276 tons per year Volatile organic compounds = 193 tons per year Carbon dioxide = 10.1 million tons per year

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 4 of 19)

Noise		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for noise impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** During decommissioning, noise would generally be far enough away from sensitive receptors outside the plant boundaries that the noise would be attenuated to nearly ambient levels and would be scarcely noticeable offsite. Noise abatement procedures could also be used during decommissioning in order to reduce noise. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL** (plant and pipeline): Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts of the plant during operations would include noise from the mechanical draft cooling towers which would be located near the center of the ONS site. The noise impacts are not anticipated to be greater than those currently associated with ONS. No noise impacts would occur from operation of the pipeline beyond intermittent maintenance activities.
New nuclear plant alternative	**ALWR Component**	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction. During operations, site characteristics and distance would attenuate sound levels. The main sources of noise would be the four mechanical draft cooling towers. The overall projected combined ambient and cooling-tower noise levels range from approximately 48 to 64 dBA.
	SMR Component	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would include noise from the mechanical draft cooling towers which would be located near the center of the ONS site. The noise impacts would be similar to those currently associated with ONS.
Combination of alternatives		**SMALL** (NGCC): The NGCC component is the same as for NGCC plant alternative above**.** **SMALL to MODERATE** (solar PV and onshore wind): Noise impacts from construction activities for the solar facility would be intermittent and last only through the duration of construction; however, given the acreage of the solar installations and the number of turbines that would need to be installed requiring land clearing, noise impacts would range from SMALL to MODERATE. No noise impacts would occur from operation of the solar PV facility. The wind turbines will emit nuisance-level noise during operation.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 5 of 19)

Geology and Soils		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for geology and soils in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** Termination of nuclear plant operations is not expected to impact geology and soils. Erosion problems could be mitigated by using BMPs during decommissioning. Site geologic resources would not be affected by decommissioning. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
New nuclear plant alternative	**ALWR Component**	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
	SMR Component	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
Combination of alternatives		**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 6 of 19)

Surface Water		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Surface water use and quality (non-cooling system impacts) Altered current patterns at intake and discharge structures Altered thermal stratification of lakes Scouring caused by discharged cooling water Discharge of metals in cooling system effluent Discharge of biocides, sanitary waste, and minor chemical spills Surface water use conflicts (plants with once-through cooling systems) Effects of dredging on surface water quality Temperature effects on sediment transport capacity
Termination of operations and decommissioning		**SMALL**: The NRC concluded that the impacts on water use and water quality from decommissioning would be SMALL for all plants. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL**: Construction impacts would be minimized through implementation of BMPs; during operations, the use of cooling towers drawing makeup water from Lake Keowee; cooling water discharges to Lake Keowee would be regulated under a NPDES permit.
New nuclear plant alternative	**ALWR Component**	**SMALL**: Construction impacts would be minimized through compliance with NPDES and USACE permitting and FERC authorizations and implementation of a SWPPP and BMPs. Impacts on surface water quality from the operation are limited to residual heat in blowdown water, water treatment chemicals in blowdown water, and concentrated solutes from the Broad River. Sanitary wastewater would be transferred to a public wastewater treatment plant.
	SMR Component	**SMALL**: Construction impacts would be minimized through implementation of BMPs and similar to those in the NGCC alternative; during operations, closed loop cooling requiring makeup water from Lake Keowee and water discharges would be regulated under a NPDES permit to protect water quality.
Combination of alternatives		**SMALL** (NGCC): The NGCC component is the same as for NGCC plant alternative above. **SMALL** (solar PV and onshore wind): Temporary soil impacts from construction would be minimized by implementation of BMPs. Once in operation, the facilities would operate in compliance with state and local stormwater regulations.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 7 of 19)

Groundwater		
Proposed action		**SMALL**: Adopting by reference the Category 1 issue finding for groundwater contamination and use (non-cooling system impacts); groundwater use conflicts (plants that withdraw less than 100 gpm); and groundwater quality degradation resulting from water withdrawals in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. **SMALL** (radionuclides released to groundwater): No unplanned radioactive liquid releases were reported between 2014 and 2018. Water from station uses continues to be processed and monitored in compliance with licensing and permitting, Duke Energy concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond Duke Energy's existing groundwater monitoring program.
Termination of operations and decommissioning		**SMALL**: Decommissioning activities include some that may affect groundwater quality through the infiltration of water used for various purposes (e.g., cooling of cutting equipment, decontamination spray, and dust suppression). BMPs are expected to be employed as appropriate to collect and manage these waters. Groundwater chemistry may change as rainwater infiltrates through rubble. The increased pH could promote the subsurface transport of radionuclides and metals. However, this effect is expected to occur only over a short distance as a function of the buffering capacity of soil. Offsite transport of groundwater contaminants is not expected. (NRC 2013a)
NGCC plant alternative		**SMALL**: No use of groundwater for construction activities and minor dewatering, if any. BMPs and SPCC plans would minimize impacts to groundwater quality as a result of stormwater runoff and spills during construction and operation.
New nuclear plant alternative	**ALWR Component**	**SMALL:** Groundwater would not be used as a water-supply source during construction or operations at W.S. Lee Nuclear Station. Excavations at the W.S. Lee Nuclear Station site and make-up pond C would require dewatering. The potential drawdown from the nuclear island foundations was estimated to extend approximately 1,700 feet, well away from the nearest residential groundwater supply well. The drawdown from make-up pond C was similarly estimated to be localized. BMPs and SPCC plans would minimize impacts to groundwater quality as a result of stormwater runoff and spills during construction and operation.
	SMR Component	**SMALL:** No use of groundwater for construction activities and minor dewatering, if any. BMPs and SPCC plans would minimize impacts to groundwater quality as a result of stormwater runoff and spills during construction and operation.
Combination of alternatives		**SMALL:** The NGCC component same as for NGCC plant alternative above**.** A well could be installed to provide groundwater for use during construction and operations at solar and wind facility sites where municipal water is not available. Wells would be installed and operated in accordance with state and local regulations. Groundwater would be protected through the implementation of SWPPP and spill prevention measures.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 8 of 19)

Terrestrial	
Proposed action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Exposure of terrestrial organisms to radionuclides Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) Bird collisions with plant structures and transmission lines Transmission line right-of-way management impacts on terrestrial resources Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) **SMALL** (effects on terrestrial resources—non-cooling system impacts): No license renewal-related refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls in place to protect terrestrial ecosystems.
Termination of operations and decommissioning	**SMALL:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect terrestrial biota, but at a reduced level of impact. Areas disturbed or used to support decommissioning are within the operational areas of the site and are also within the protected area. Decommissioning activities conducted within the operational areas are not expected to have a detectable impact on important terrestrial resources. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	**SMALL** (plant): Construction on the ONS site would utilize developed land and some forested land. The forested area across SC-183 (approximately 30 acres) would have the greater potential of displacing wildlife because it includes previously undisturbed habitat; however, use of higher-quality wildlife habitat of hardwood and mixed hardwood forest could be avoided. Implementation of construction BMPs for erosion and dust control, noise abatement, proper equipment maintenance, restricting the timing of activities to minimize impacts to resources such as breeding birds, and adherence to applicable permit conditions would minimize impacts. NGCC plant has higher air emissions than a nuclear plant; operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation; noise from the cooling tower could also impact wildlife. **SMALL** (pipeline): It is expected the project would displace wildlife along the pipeline corridor. However, the pipeline corridor would be revegetated after installation of the pipeline and some wildlife species would reoccupy portions of the corridor. Pipeline installations typically result in temporary disruptions to wildlife.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 9 of 19)

Terrestrial (continued)		
New nuclear plant alternative	**ALWR Component**	**MODERATE (construction):** Habitat loss and wildlife mortality, disturbance, and displacement would be substantial and mostly permanent in nature. Development at the W.S. Lee Nuclear Station site would impact approximately 946 acres, including temporary habitat alteration (327 acres) and permanent habitat loss (619 acres). Creation of make-up pond C would affect about 821 acres of forest (of which about 545 acres are relatively undisturbed mixed hardwood and mixed hardwood-pine forest) along most of the length of London Creek and its tributaries. Development of make-up pond C would inundate seven significant natural areas, four noteworthy ecological associations of concern to the state, occurrences of five uncommon plant species. **SMALL (operations):** The potential impacts on vegetation, birds, and shoreline habitat are likely to be minor. The potential impacts of transmission line operation on birds, and transmission line corridor maintenance on important habitats, including floodplains and wetlands, are considered minor.
	SMR Component	**SMALL:** Construction activities for the SMR facility would be confined to the ONS site, primarily utilizing developed land, open space next to operating industrial facilities. Prior to tree removal, wildlife surveys would be conducted to identify protected species and habitat and design appropriate avoidance and minimization measures. The operating SMR facility would have the same types of operational noise as the ONS with the exception of noise from the cooling towers which would attenuate due to surrounding structures and distance. Emissions from the mechanical draft cooling towers would be regulated by air quality standards.
Combination of alternatives		**SMALL** (NGCC): The NGCC component is the same as for NGCC plant above. **SMALL to MODERATE** (solar PV): The large land requirement could impact terrestrial habitats; however, site selection would avoid wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. **SMALL** (onshore wind): Site selection would avoid wetlands and other high-quality terrestrial habitats such as critical habitat for threatened and endangered species and habitats identified as a priority for preservation. Site selection would also follow USFWS guidance for land-based wind energy development. The operation of the wind turbines could affect avian and bat species. Compliance with any incidental take permits would minimize impacts to special status species.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 10 of 19)

Aquatic	
Proposed action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Entrainment of phytoplankton and zooplankton (all plants) Infrequently reported thermal impacts (all plants) Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication Effects of nonradiological contaminants on aquatic organisms Exposure of aquatic organisms to radionuclides Effects of dredging on aquatic organisms Effects on aquatic resources (non-cooling system impacts) Impacts of transmission line ROW management on aquatic resources Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses **SMALL** (impingement and entrainment of aquatic organisms—plants with once-through cooling systems or cooling ponds): Lake Keowee fishery resources have been monitored by various sources (USFWS, SCDNR, and Duke Energy) since 1972. Fish populations have remained stable and similar to studies conducted since 1993, indicating that continued operation of ONS will have little to no long-term impact on fish populations in Lake Keowee. Duke Energy complies with the current NPDES permit and will comply with future renewal of the permit, implementing any best available technology requirements to minimize impacts of impingement and entrainment. **SMALL** (thermal impacts on aquatic organisms—plants with once-through cooling systems or cooling ponds): The thermal discharge associated with ONS discharge has been demonstrated to be protective of the Lake Keowee fishery. No deleterious impacts from thermal inputs were observed in the phytoplankton community in Lake Keowee and no large populations of thermally tolerant species or nuisance algae were observed. No shifts toward dominance of thermally tolerant zooplankton taxa were observed and the majority of abundant taxa from previous studies in the 1970s and 1989–2005 were still common and abundant during the later study period (2006–2011). The operation of ONS appears to have little long-term impact on sportfish populations, and a balanced, indigenous fish community exists in Lake Keowee.
Termination of operations and decommissioning	**SMALL**: The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The NRC concluded that for facilities at which the decommissioning activities would be limited to existing operational areas, the potential impacts on aquatic resources would be SMALL. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	**SMALL**: Implementation of BMPs would minimize impacts on aquatic ecosystems during construction; during operations, water withdrawal is estimated at 11 MGD; discharges would be governed under a NPDES permit.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 11 of 19)

Aquatic (continued)		
New nuclear plant alternative	**ALWR Component**	**MODERATE** (construction): Construction would involve potential impacts on aquatic biota in the Broad River and Ninety-Nine Islands Reservoir and onsite ponds and streams; inundation of London Creek and its tributaries; and potential impacts to other offsite waterbodies associated with transmission line corridors. **SMALL** (operations): Impingement and entrainment impacts to the aquatic ecology of the site and environs from operation of the Broad River intake structure are likely to be minimal due to the use of closed-cycle cooling and the location and design of the intake structure. Impacts to aquatic biota from operation of intakes in make-up ponds A, B, and C are also likely to be minor. Impacts on aquatic organisms in the Broad River due to the discharge could result from thermal, chemical, and physical effects on the substrate and hydrological changes. Thermal impacts on fish populations from the discharge of heated water from the proposed W.S. Lee Nuclear Station are expected to be minor because of the small increase in temperature over ambient conditions and the small extent of the thermal plume. Based on the estimated discharge concentrations and the water treatment chemicals planned, the impacts from chemical discharges to the Broad River are expected to be minimal.
	SMR Component	**SMALL**: Implementation of BMPs would minimize impacts on aquatic ecosystems during construction; during operations, cooling water makeup for the cooling towers would be withdrawn from Lake Keowee; withdrawals and discharges would be governed under a NPDES permit.
Combination of alternatives		**SMALL**: The NGCC component is the same as for NGCC plant alternative above; no impacts would result from the solar PV and offshore wind components.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 12 of 19)

Special Status Species	
Proposed action	**NO EFFECT**: No license renewal-related refurbishment or other license renewal-related construction activities have been identified. Maintenance activities necessary to support license renewal would be limited to previously disturbed areas onsite, and no additional land disturbance has been identified for the purpose of SLR. No EFH exists at Lake Keowee and no habitat areas of particular concern (HAPCs) or EFH areas protected from fishing are located on or adjacent to ONS. Eight federally listed threatened or endangered species and the BGEPA-protected bald eagle potentially occur within a 6-mile radius of ONS. No critical habitat for these species exists within a 6-mile radius of ONS. Duke Energy maintains plans for avian protection. The closest active eagle nest is located 14 miles away. Suitable habitat for the northern long-eared bat exists on the ONS site, but acoustic surveys found no evidence that the northern long-eared bat uses the site. Surveys identified state-listed Rafinesque's big eared bats and eastern small-footed bats in the vicinity of the site, but not the state-listed Indiana bat. Suitable habitat for the bog turtle, which is also state-listed, exists near the ONS site, but no individuals have been documented on the site or nearby vicinity. Suitable habitat for the other six federally protected species, all plants, does not occur on ONS. In addition to the three bat species and the bog turtle mentioned as state-listed, there are two avian species and a lizard species that occur in Oconee and Pickens counties. Suitable habitat for the state-listed lizard, the southern coal skink, may exist on the ONS site or in its vicinity; however, no individuals were identified during biological surveys. Continued operation of ONS is not likely to affect these species. Duke Energy's compliance with federal, state, and local laws and regulations will minimize potential impacts to these species.
Termination of operations and decommissioning	**Site Specific**: The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The magnitude of impacts could vary widely based on site-specific conditions at the time of decommissioning and the presence or absence of special status species and habitats when the alternative is implemented. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative	**NO EFFECT** (plant): The potential for occurrence of special status species on the ONS site is as described for the proposed action above. The portion of the NGCC plant constructed across from the ONS site could avoid higher-quality wildlife habitat of hardwood and mixed hardwood forest. Surveys would be undertaken as appropriate to support siting and allow avoidance of sensitive habitats and protected species. **NOT LIKELY TO ADVERSELY AFFECT** (pipeline construction): Federally and state-listed species may be found in pipeline corridor; however, surveys would be required to determine if the species is present within or adjacent to the corridor and mitigation measures implemented as needed.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 13 of 19)

Special Status Species		
New nuclear plant alternative	**ALWR Component**	**NOT LIKELY TO ADVERSELY AFFECT**: No impacts to known federally threatened, endangered, proposed, or candidate animal or plant species and no impacts to known state-listed species from the proposed W.S. Lee Nuclear Station and offsite infrastructure development. There are no areas designated as critical habitat for threatened and endangered species in the vicinity of the W.S. Lee Nuclear Station site. One state-listed fish species, the Carolina fantail darter has been captured in the vicinity of the intake structure. Impacts to the state-listed Carolina fantail darter fish species are expected to be minimal based on its habitat preferences and adhesive egg-laying characteristics.
	SMR Component	**NO EFFECT**: Potential for impacts as described for the proposed action above. Prior to tree removal, wildlife surveys would be conducted as done for recent expansion of the onsite ISFSI to identify protected species and habitat and design appropriate avoidance and minimization measures.
Combination of alternatives		**NO EFFECT**: The NGCC component is the same as for NGCC plant alternative above. **NOT LIKELY TO ADVERSELY AFFECT** (solar PV and onshore wind): The site selection process would seek to avoid locations whose development would impact special status species. USFWS guidance for tree removal and harvesting and avoiding nesting and roosting site would be followed.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 14 of 19)

Historic and Cultural Resources		
Proposed action		**NO ADVERSE EFFECT**: No license renewal-related refurbishment or construction activities identified; administrative controls ensure protection of cultural resources in the event of excavation activities.
Termination of operations and decommissioning		**NO ADVERSE EFFECT**: The termination of nuclear plant operations would not affect historic or cultural resources. The NRC conducted an analysis of the potential effects of decommissioning on historic and archaeological (cultural) resources and found that the potential onsite impacts at sites where the disturbance of lands would not go beyond the operational areas would be SMALL. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**ADVERSE EFFECT**: Cultural resources include a NRHP site adjacent to the ONS site and an old family burial ground onsite. The proximity to the NRHP site could result in adverse effect after mitigation measures however, without additional studies would be needed to inform the analysis. The pipeline corridor siting process would seek to avoid historic and cultural resources. Construction would avoid the sites or evaluate the sites and development management plans and practices for sites that cannot be avoided.
New nuclear plant alternative	**ALWR Component**	**NO ADVERSE EFFECT**: Investigators identified four historic cemeteries within the 1,900-acre W.S. Lee Nuclear Station site, none eligible for nomination to the NRHP, but protected by state law. A family cemetery would have to be relocated for make-up pond C. No traditional cultural places of importance to interested American Indian tribes have been identified at the W.S. Lee Nuclear Station site. The NRC concluded that potential direct and indirect impacts on historic and cultural resources during construction would be MODERATE.
	SMR Component	**NO ADVERSE EFFECT**: Duke Energy's site planning process would seek to avoid or mitigate impacts to cultural resources. Any new construction would follow all state and federal requirements and the appropriate field studies would be conducted. The SMR site would abut the onsite cemetery and actions would be taken to preserve the integrity of the site. Portions of the SMR site would also share a border with the Old Pickens Presbyterian Church and cemetery property. The grounds of the Old Pickens Presbyterian Church and cemetery are not contiguous with the ONS property line and are surrounded by trees, mitigating the potential for impacts from construction activities (e.g., impacts from noise and fugitive dust) as well as visual impacts from construction or operations.
Combination of alternatives		**ADVERSE EFFECT**: The NGCC component is the same as for NGCC plant alternative above. **NO EFFECT** (solar PV and onshore wind): Historic and archeological resources would be assessed, and impacts avoided during the site selection process for the solar PV and onshore wind sites.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 15 of 19)

Socioeconomics	
Proposed action	**SMALL**: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Employment and income, recreation and tourism Tax revenues Community services and education Population and housing Transportation
Termination of operations and decommissioning	When a nuclear power plant is closed and decommissioned, most of the important socioeconomic impacts will be associated with the plant closure rather than with the decommissioning process (NRC 2002, Section 4.3.12). **MODERATE to LARGE** (adverse): Terminating nuclear plant operations would have a noticeable adverse impact on socioeconomic conditions in the region around the nuclear power plant. There would be immediate socioeconomic impacts from the loss of jobs. The impacts from the loss or reduction of tax revenue due to the termination of plant operations on community and public education services could range from SMALL to LARGE. (NRC 2013a, Section 4.12.2.1) The FY 2019 Duke Energy's property tax payments to Oconee County were approximately 73 percent of the county's overall property tax revenues (Section 3.9.5). The plant staff assumed to reside in Oconee County, approximately 698 (Section 2.5), is a small percentage of Oconee County's employed population of 33,317 (Section 3.9.1). Therefore, the loss of jobs would affect a small percentage of the population, but the tax revenue loss would have a noticeable and potentially destabilizing impact on Oconee County. **SMALL** (adverse): Decommissioning itself has no impact on the tax base and no detectable impact on the demand for public services. The impacts of decommissioning on socioeconomics are neither detectable nor destabilizing; therefore, the impacts on socioeconomics are SMALL. (NRC 2002, Section 4.3.12.3 and 4.3.12.4)
NGCC plant alternative	**SMALL** (construction, adverse due to increased pressure on housing and demand for community services): The jobs created to complete the construction of the NGCC plant and natural gas pipeline would be temporary in duration and any in-migration would be temporary. **SMALL** (construction, beneficial): The jobs created to complete the construction of the NGCC plant and natural gas pipeline would be temporary in duration and would have a temporary stimulus to the local economy. **SMALL** (operations, adverse): The NGCC plant would have fewer workers than ONS and would have less demand on local services. **MODERATE** (operations, beneficial): The socioeconomic impacts resulting from the operation of the NGCC plant would be less than the current socioeconomic impact of ONS as fewer workers would be employed at the NGCC plant. Tax payments for an operating plant would have a significant beneficial impact on Oconee County. **MODERATE** (construction traffic): The increase in traffic during construction would be short-term and noticeable and could exceed local roadway capacity during peak times given that existing units would remain operational during the construction time period.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 16 of 19)

Socioeconomics (continued)		
NGCC plant alternative (continued)		**SMALL** (operations traffic): Traffic impacts associated with the operation of the NGCC plant would be less than current operations given the smaller operations workforce.
New nuclear plant alternative	**ALWR Component**	**SMALL** (construction, adverse): The in-migration of approximately 70 percent of the workforce would result in increased demand for housing, recreation, and infrastructure and community services. **MODERATE** (construction, beneficial economic): Construction would involve a 93-month construction schedule and a peak workforce of 4,613 workers, providing a stimulus to the Cherokee County economy. **SMALL** (operations, adverse): The in-migration rate of 36 percent would increase population but the additional stress on existing public services such as education, medical, fire, and police services would be small across the region. **LARGE** (operations, beneficial): Plant operations employment would be long-term and fee-in-lieu payments to Cherokee County would provide additional stimulus to the local economy. **MODERATE** (construction traffic): Construction would increase traffic on the roads and congestion. Impacts could be mitigated by use of staggered shifts and implementation of planned upgrades and improvements to the road systems. **SMALL** (operations traffic): Transportation impacts would decrease after construction and use of staggered shifts would mitigate impacts.
	SMR Component	**SMALL** (construction, adverse): The construction workforce would be similar to that of the NGCC plant and are described above. **SMALL** (operations, adverse): It is assumed that the current workforce could be used to supply the SMR workforce, which negates the need for the in-migration of workers. **MODERATE** (operations, beneficial): The SMR facility would have similar significant benefit to Oconee County from taxes as ONS does. Some economic loss would be expected in communities where ONS employees live and shop because fewer workers would be employed at the SMR facility. **SMALL to MODERATE** (construction traffic): The construction workforce and level of construction activities for the SMR facility would be similar to that of the NGCC plant. **SMALL** (operations traffic): The SMR operations workforce would be smaller than the current ONS operations workforce and local roadways are already handling the current larger workforce.
Combination of alternatives		**SMALL** (adverse); **MODERATE** (beneficial): The NGCC component is the same as for NGCC plant alternative above. **SMALL** (solar PV and onshore wind): The jobs created to complete the construction of the solar PV and wind installations would less than those needed for the NGCC plant and temporary. Construction could increase traffic on the roads but would be less than other alternatives. Few employees are required for maintenance and operation. Demand-side management programs could also have a minimal beneficial socioeconomic impact due to purchase of and installation labor for energy efficient building materials and appliances.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 17 of 19)

Human Health		
Proposed action		**SMALL**: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Radiation exposures to the public Radiation exposures to plant workers Human health impact from chemicals Microbiological hazards to plant workers Physical occupational hazards **SMALL** (microbiological hazards to the public [plants with cooling ponds or canals or cooling towers that discharge to a river]): Microbiological hazards to public are considered to be small given that ongoing, continuous field measurements show water temperatures nearest the thermal discharge are below the optimum for growth of thermophilic microorganisms. The discharge area's location away from public boating and swimming areas, along with ONS controls, also mitigates public exposure. **SMALL** (electric shock hazards): Transmission lines located entirely within ONS property and the potential for a steady-state discharging current from the aboveground lines is less than the NESC standard of 5 mA rms. Duke Energy adheres to NESC code compliance requirements for shock hazard avoidance and maintains worker and visitor safety through design ground clearances and other shock prevention measures.
Termination of operations and decommissioning		**SMALL**: The human health impacts from physical, chemical, and microbiological hazards during the termination of plant operations and decommissioning would be SMALL for all plants. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL**: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction and operations; air emissions would be subject to regulatory standards that are protective of human health. The radiological human health impact on workers due to working in proximity to ONS would be SMALL due to compliance with NRC regulations and adherence to ALARA principles.
New nuclear plant alternative	**ALWR Component**	**SMALL**: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction and operation. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principles.
	SMR Component	**SMALL**: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction; human health impacts during operation would be similar to ONS. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principles.
Combination of alternatives		**SMALL**: Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during NGCC plant construction and operations; air emissions would be subject to regulatory standards that are protective of human health; impacts from solar PV and onshore wind installations construction would similarly keep impacts on workers at acceptable levels and there are no expected operational impacts. Noise levels from wind turbines have no direct impact on physical human health.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 18 of 19)

Environmental Justice		
Proposed action		**No disproportionately high and adverse impacts to minority and low-income populations**: The closest low-income and minority populations are 8 and 15 miles, respectively, from the ONS center point (Section 3.11.2). There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the proposed action.
Termination of operations and decommissioning		Termination of power plant operations and the resulting loss of jobs, income, and tax revenue could have a disproportionate effect on minority and low-income populations (NRC 2013a, Section 4.12.2). **Site Specific**: The determination of whether the minority or low-income populations are disproportionately highly and adversely impacted by facility decommissioning activities needs to be made on a site-by-site basis because their presence and their socioeconomic circumstances will be site specific (NRC 2002, Section 4.3.13.3). The closest low-income and minority populations are 8 and 15 miles, respectively, from the ONS center point (Section 3.11.2).
NGCC plant alternative		**No disproportionately high and adverse impacts to minority and low-income populations**: The closest minority or low-income population that meets NRC environmental justice guidance criteria is adjacent to the ONS site. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. No disproportionately high and adverse effects to low-income and minority communities are associated with NGCC plant operations. This conclusion is based on no change in operations activities associated with the NGCC plant versus ONS with the exception of air emissions. Air emissions would be mitigated with installation of best available pollution control technology on the plant.
New nuclear plant alternative	**ALWR Component**	**No disproportionately high and adverse impacts to minority and low-income populations**: There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of the W.S. Lee Nuclear Station.
	SMR Component	**No disproportionately high and adverse impacts to minority and low-income populations**: The closest minority or low-income population that meets NRC environmental justice guidance criteria is adjacent to the ONS site. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations.
Combination of alternatives		**No disproportionately high and adverse impacts to minority and low-income populations**: NGCC component same as for NGCC plant alternative above. Impacts during construction of the solar PV and onshore wind facilities would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 19 of 19)

Waste Management		
Proposed action		**SMALL**: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Low-level waste storage and disposal Onsite storage of spent nuclear fuel Offsite radiological impacts of spent nuclear fuel and high-level waste disposal Mixed waste storage and disposal Nonradioactive waste storage and disposal
Termination of operations and decommissioning		**SMALL**: After termination of nuclear plant operations, there would be a period before the beginning of decommissioning when the reactor would be placed in a cold shutdown condition and maintained. The quantities of waste generated would be smaller than the quantities generated during either operations or decommissioning. The impacts associated with the management of LLRW, hazardous waste, mixed waste, and nonradioactive and nonhazardous waste during operations and decommissioning would be SMALL. (NRC 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL**: Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; spent selective catalytic reduction catalysts would make up the majority of the waste during operations; operations-related waste would be managed and recycled or disposed of at permitted offsite facilities.
New nuclear plant alternative	**ALWR Component**	**SMALL**: Construction-related waste would be properly characterized and disposed of at permitted offsite facilities. USACE permits for disposal of dredged spoils would be obtained and implemented. During operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
	SMR Component	**SMALL**: Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
Combination of alternatives		**SMALL**: The NGCC component is the same as for NGCC plant alternative above. Construction of the solar PV and onshore wind facilities would create sanitary and industrial wastes, although it will be in smaller quantity as compared to the NGCC plant. All waste generated at the solar PV and wind installations would be recycled or disposed of at an offsite waste disposal facility. Demand-side management energy efficiency programs could result in a minimal decrease in landfill capacity due to the disposal of replaced appliances.

9.0 STATUS OF COMPLIANCE

The ER shall list all federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The ER shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land use regulations, and thermal and other water pollution limitation or requirements which have been imposed by the federal, state, regional, and local agencies having responsibility for environmental protection. [10 CFR 51.45(d)]

9.1 ONS Authorizations

Table 9.1-1 provides a summary of authorizations held by ONS for current plant operations. Authorizations in this context include any permits, licenses, approvals, or other entitlements that would continue to be in place, as appropriate, throughout the period of extended operation given their respective renewal schedules. Table 9.1-2 lists additional environmental authorizations and consultations related to the renewal of the ONS Units 1, 2, and 3 ROLs.

Table 9.1-1 Environmental Permits for Current Operations at ONS (Sheet 1 of 6)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
NRC	Atomic Energy Act, 10 CFR 50	ONS license to operate Unit 1	DPR-38	2/6/2033	Operation of ONS Unit 1
NRC	Atomic Energy Act, 10 CFR 50	ONS license to operate Unit 2	DPR-47	10/6/2033	Operation of ONS Unit 2
NRC	Atomic Energy Act, 10 CFR 50	ONS license to operate Unit 3	DPR-55	7/19/2034	Operation of ONS Unit 3
NRC	10 CFR Part 72, Subpart B	Site-specific ISFSI	SNM-2503	1/31/2050	Operation of a dry storage ISFSI under a site-specific license.
NRC	10 CFR Part 50 10 CFR Part 72, Subpart K	ISFSI	N/A	7/19/2034	Operation of a dry storage ISFSI under the ONS units' licenses.
Atlantic Compact Commission	Omnibus Low-Level Radioactive Waste Interstate Compact Consent Act (1980 and amended in 1985)	Compacts have the authority to limit the export or import of LLRW out of or into the compact region.	N/A	N/A	Atlantic Interstate LLRW Management Compact does not require import or export permits.
FERC	Federal Power Act, 18 CFR 5.1	Keowee-Toxaway Hydroelectric Project license	2503-154	August 31, 2046	Operate and maintain the Keowee-Toxaway Hydroelectric Project (the project provides backup power for ONS and includes the ONS intake dike).

Table 9.1-1 Environmental Permits for Current Operations at ONS (Sheet 2 of 6)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
USACE	Article 403 of Keowee-Toxaway Hydroelectric Project license	Operating agreement for Duke Energy projects and downstream federal projects	None	August 31, 2046	Agrees to a new critical reservoir elevation for Lake Keowee of 790 feet above msl.
USFWS	Migratory Bird Treaty Act 50 CFR Part 13 50 CFR 21.27	Migratory bird SPUT	MB000257-0	3/1/2022	Authorized to collect, transport, and temporarily possess carcasses and partial remains of migratory birds and emergency relocation of nests of migratory birds other than eagles or threatened or endangered species.
USFWS	Migratory Bird Treaty Act 50 CFR Part 13 50 CFR 21.41	Migratory bird depredation permit	MB48760D-0	3/31/2021	Authorized to take black vultures and turkey vultures at ONS for depredation control purposes.
USDOT	49 CFR 107 Subpart G	Registration	Reg. No: 052820550017C	6/30/2021	Hazardous materials shipments.
EPA	40 CFR 261	Small quantity hazardous waste generator	SCD043979822	12/31/2019	Hazardous waste generator registration.

Table 9.1-1 Environmental Permits for Current Operations at ONS (Sheet 3 of 6)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
SCDHEC	Coastal Zone Management Act Section 307(c)(3)(A)	Consistency determination with the SC Coastal Management Program	NA	NA	ONS is not located in the SC coastal zone.
SCDHEC	SC R. 61-119	Surface water withdrawal permit	37PN001	10/29/2043	Surface water withdrawal from Lake Keowee.
SCDHEC	South Carolina Groundwater Use and Reporting Act	Coastal plain groundwater withdrawals	NA	NA	ONS is not located in the coastal plain and is not required to permit and report groundwater withdrawals.
SCDHEC	SC R.61-62	Conditional major operating permit, air sources	CM-1820-0041	12/31/2027	Operation of auxiliary boiler.
SCDHEC	SC R.61-79.262.13	SQG annual declaration	DHEC 2701 form	Annual submittal	Annual SQG declaration.
SCDHEC	SC 61-107.19	Class 2 landfill post-closure permit	373303-1601	1/11/2038	Post-closure permit for closed and capped onsite landfill.
SCDHEC	40 CFR 280; SC R. 61-92	UST registration for SC regulated tanks	Registration numbers: 11174 and 11843	7/31/2021	Operation of seven USTs under registration number 11843 and one UST under registration 11174.

Table 9.1-1 Environmental Permits for Current Operations at ONS (Sheet 4 of 6)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
SCDHEC	Clean Water Act, Section 402; SC R. 61-9	NPDES permit	SC0000515	9/30/2013 (due to submittal of a timely renewal application the permit is administratively extended and remains in effect until a final permit decision is made on the renewal)	Discharges of wastewater to surface water.
SCDHEC	SC R. 61-9	NPDES general permit for discharges from pesticide application	SCG160000 Facility Coverage No. SCG16006	3/31/2021	Discharges to surface waters from pesticide application.
SCDHEC	40 CFR122.26; SC R. 61-9	General NPDES permit for construction activities	SCR100000	12/31/2017 (this general permit continues in effect until the subsequent general permit becomes effective)	Discharge of stormwater; ONS files notices of intent for construction activities under the general construction stormwater permit.
SCDHEC	SC R. 61-9	General NPDES permit for industrial activities	SCR000000 Facility Coverage No. SCR000074	9/30/2021	Discharge of industrial stormwater permit.
SCDHEC	SC R. 61-9.610	Operation of a satellite sewer system	Permit Coverage No. SSS000909	NA	Notification of satellite sewer owner.

Table 9.1-1 Environmental Permits for Current Operations at ONS (Sheet 5 of 6)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
SCDNR	Migratory Bird Treaty Act	Migratory bird depredation permit	MD-4-20	12/31/2020	State authorization associated with the USFWS MB000257-0 permit.
SCDHEC	SC R. 61-81	Environmental laboratory certification	Certification No. 37756001	3/3/2021	Certifies testing for pH, residual chlorine, and temperature.
SCDHEC	SC R. 61-81	Environmental laboratory certification	Certification No. 37761001	3/5/2021	Certifies testing for pH.
SCDHEC	SC R. 61-105	Infectious waste registration	Registration No. SC37-0051G	7/31/2022	Registers ONS as a generator of infectious waste.
SCDHEC	SC R. 61-86.1	Group license for asbestos abatement activities	Group License No. 8045	12/29/2021	Licenses individuals for asbestos abatement activities onsite.
SCDHEC	SC Radioactive Waste Transportation and Disposal Act, SC R. 61-83	SC radioactive waste transport permit	0020-39-20-X	12/31/2020	Transport of radioactive waste within South Carolina.
Tennessee Department of Environmental Control (TDEC)	TDEC Rule Chapter 0400-20-10-.31 & .32	Radioactive waste license-for-delivery	T-SC007-L20	12/31/2020	Shipment of radioactive material to a licensed disposal/processing facility within Tennessee.

Table 9.1-1 Environmental Permits for Current Operations at ONS (Sheet 6 of 6)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
OJRSA	SC R. 61-9	Significant industrial wastewater discharge permit	IW-000003	3/31/2024	Discharge of industrial wastewater into the Coneross Creek wastewater treatment facility.

Table 9.1-2 Environmental Authorizations and Consultations for ONS License Renewal

Agency	Authority	Requirement	Remarks
NRC	Atomic Energy Act [42 USC 2011 et seq.]	License renewal	Applicant for federal license must submit an ER in support of license renewal application.
USFWS	Endangered Species Act Section 7 [16 USC 1636]	Consultation	Requires federal agency issuing a license to consult with the USFWS, regarding federally protected species.
SCDNR	10 CFR 51, Subpart A, Appendix B, Table B-1, Special Status Species and Habitat	Consultation	State-level agency for South Carolina protected species to assist in identifying adverse impacts to protected species resulting from continued operation of the facility.
South Carolina Department of Archives and History	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Eastern Band of Cherokee Indians	National Historic Preservation Act Section 110	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
United Keetoowah Band of Cherokee Indians in Oklahoma	National Historic Preservation Act Section 110	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Cherokee Nation	National Historic Preservation Act Section 110	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Catawba Indian Nation	National Historic Preservation Act Section 110	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
SCDHEC	10 CFR 51, Subpart A; Regulatory Guide 4.2, Rev. 1, Supplement 1, Section 3.9	Consultation	The applicant should consult the State agency responsible for environmental health regarding the potential existence and concentration of microorganisms in the receiving waters for plant cooling water discharge.
SCDHEC	Clean Water Act Section 401 [33 USC 1341)	Certification or waiver	Requires applicant to provide state's certification or waiver to the federal agency issuing the license that the license is protective of the state's water quality standards.

9.2 Status of Compliance

ONS has established control measures in place to ensure compliance with the authorizations listed in Table 9.1-1, including monitoring, reporting, and operating within specified limits. Monitoring and sampling results associated with environmental programs are submitted to appropriate agencies, as specified in the permits and/or governing regulations.

9.3 Notices of Violations

Based on a review of records over 2014–October 2020 of various environmental programs and permits that ONS is subject to and complies with, there have been two notices of violations (NOVs) issued to the facility by federal (i.e., agencies other than the NRC), state, or local regulatory agencies. One of the NOVs was issued by SCDHEC for an NDPES permit exceedance for oil and grease at Outfall 007 in February 2017. Duke Energy later revised the February 2017 discharge monitoring report to clarify that the exceedance event was not the result of a release from NPDES Outfall 007 for the Keowee Hydroelectric Station. As a result of this clarification, SCDHEC rescinded the NOV. The second NOV was issued in March 2014 by the SCDHEC for exceeding the maximum daily NPDES permit limit for oil and grease at Outfall 002 in January 2014. Duke Energy reported that a January 7, 2014, oil and grease sample had a test result of 6.0 mg/l oil and grease, exceeding the practical quantitation limit of 5.0 mg/l. The results for two additional samples collected on January 20, 2014, did not exceed permit limits. Further, there were no known plant leaks or spills of oil on or immediately before the exceedance that would account for the exceedance.

9.4 Remediation Activities

Based on reviews of records conducted in April 2019 and October 2020, no remediation activities for nonradioactive or radioactive environmental concerns have been conducted since 2014 or are ongoing with the exception of those activities associated with the ONS' Groundwater Protection Initiative. As discussed in Section 3.6.4.2, tritium concentrations have been detected in two groundwater monitoring wells installed as part of the Groundwater Protection Initiative in 2010. The probable source of this activity was determined to be a previously discontinued discharge pathway. A recovery well was installed in 2011, which has resulted in decreased tritium concentrations.

9.5 Federal, State, and Local Regulatory Standards: Discussion of Compliance

9.5.1 Atomic Energy Act

The AEA gives the NRC responsibility for licensing and regulating commercial uses of nuclear energy and allows the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under the act through regulations set forth in Title 10 of the CFR.

Per 10 CFR 50.36(a), nuclear power plants are required to submit an annual report to the NRC that lists the types and quantities of radioactive effluents released into the environment. Calculations for dose estimates to members of the public are based on radioactive gaseous and liquid effluent release data, and atmospheric and aquatic transport models. Based on review of ONS annual radioactive effluent release reports from years 2014–2019, doses to members of the public were below NRC and EPA radiation protection standards. As a generator of both LLRW and spent fuel, ONS is subject to and complies with provisions and requirements of the Low-Level Radioactive Waste Policy Amendment Act of 1985 and the Nuclear Waste Policy Act of 1982, as subsequently amended. Radioactive solid waste generation and disposal/treatment shipments are reported in ONS's annual radioactive effluent release reports as required. (Duke 2015a; Duke 2016; Duke 2017; Duke 2018; Duke 2019b).

As part of the REMP at ONS, Duke Energy also prepares an annual radiological environmental operating report for submittal to NRC. Each annual report presents the results of the monitoring program performed for the previous year and compares the results to regulatory standards, previous results, and projected results based on plant effluents. The results of the 2019 REMP sampling were within the ranges of radioactivity concentrations observed in the past and consistent with effluents introduced into the environment by plant operations (ONS 2019, Executive Summary and Section 3.0).

The NRC issued an NOV on August 12, 2014, related to a reactor coolant system leak inside the ONS Unit 1 which is a low to moderate safety or security issue. (NRC 2019j). Duke Energy implemented repairs following the November 2013 occurrence and implemented corrective actions to prevent future occurrences (Duke 2015b).

9.5.2 Clean Air Act

9.5.2.1 Air Permit

ONS operates its air emission sources in compliance with SC R. 61-62.1. ONS maintains a conditional major operating air permit for its auxiliary boiler. ONS has four portable 600-kV diesel generators of part of its diverse and flexible coping strategies (FLEX) equipment. These portable generators are designated for emergency use only and do not require permits under SC R. 61-62.1. As discussed in Section 3.3.3.2, annual updates and emission statement reports are submitted to SCDHEC each year as required by SC R. 61-62.1.

9.5.2.2 Chemical Accident Prevention Provisions [40 CFR 68]

ONS is not subject to the risk management plan requirements described in 40 CFR 68 because the amount of regulated chemicals present onsite do not exceed the threshold quantities specified in 40 CFR 68.130. Duke Energy evaluates the amount of regulated chemicals present onsite against threshold quantities on a quarterly basis under its corporate chemical control program.

9.5.2.3 Stratospheric Ozone [40 CFR 82]

Under Title VI of the CAA, the EPA is responsible for several programs that protect the stratospheric ozone layer. Regulations promulgated by the EPA to protect the ozone layer are contained in 40 CFR 82. Refrigeration appliances and motor vehicle air conditioners are regulated under Sections 608 and 609 of the CAA, respectively. A number of service practices, refrigerant reclamation, technician certification, and other requirements are covered by these programs. ONS is in compliance with Sections 608 and 609 of the CAA as amended in 1990 and the implementing regulations codified in these regulations. The program to manage stationary refrigeration appliances at ONS is described in Duke Energy's corporate procedure applicable to employees, vendors, and contractors for the management of chlorofluorocarbons, refrigerants, and halons in compliance with federal regulations.

9.5.3 Clean Water Act

9.5.3.1 Water Quality (401) Certification

Federal CWA Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters provide the licensing agency with a certification from the state that the discharge will comply with applicable CWA requirements [33 USC 1341]. The State of South Carolina issued a 401 certification to ONS on August 2, 1976, in conjunction with SCDHEC's issuance of NPDES permit SC0000515. In a September 29, 2020, letter, SCDHEC confirmed the previously issued 401 Water Quality Certification remains valid. The SCDHEC letters are included in Attachment E.

9.5.3.2 NPDES Permit

NPDES Permit No. SC0000515, issued by the SCDHEC, authorizes the discharge of non-contact cooling water, process water, service water, treated industrial wastewater, landfill leachate, treated liquid radiological waste, treated chemical metal cleaning waste, and stormwater to state waters (i.e., Lake Keowee and Keowee River) from ONS and discharges from Keowee Hydro operations (Attachment B). This permit is currently administratively extended. An application for renewal was submitted on March 23, 2013, and documented in the SCDHEC online application tracker as received on April 1, 2013 (SCDHEC 2020d).

As discussed in Section 3.6.1.2.1, wastewaters are monitored and discharged to Lake Keowee and the Keowee River via NPDES Outfalls 001, 002, 004, and 007 in accordance with the ONS NPDES Permit No. SC0000515. The current NPDES permit authorizes discharges from six outfalls (four external and two internal). These outfalls are depicted in Figure 3.6-3, and their associated effluent limits are listed in Table 3.6-2.

ONS has a CWA Section 316(a) variance and conducts studies to demonstrate that alternative thermal limits are protective of the indigenous populations of fish, shellfish, and wildlife in and on Lake Keowee and the Keowee River, and submits the results with each permit renewal application. The renewal application submitted on March 23, 2013, included the CWA Section 316(a) study results as required.

ONS includes a cooling water intake structure governed by CWA Section 316(b), which requires that the location, design, construction, and capacity of the cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. The regulation implementing Section 316(b) was finalized with an effective date of October 14, 2014, falling after Duke Energy submitted its NPDES permit renewal application. As discussed in Section 3.7.7.1, Duke Energy performed impingement and entrainment studies and submitted a CWA 316(b) report to the SCDHEC.

Construction activities resulting in land disturbance of greater than one acre must apply for permit coverage under the NPDES general permit for stormwater discharges from construction activities, Permit No. SCR100000, which grants authorization to discharge under the SC Stormwater Management Program. ONS will comply with this general permit should any construction activities be required at the site.

9.5.3.3 Industrial Stormwater Discharge

Stormwater discharge from industrial facilities is subject to permitting requirements under SC R. 61-9, and the SCDHEC has issued an NPDES general permit for stormwater discharges associated with industrial activities, Permit No. SCR000000, which grants authorization to discharge under the SC Stormwater Management Program. ONS operates in compliance with the general industrial stormwater permit and is assigned facility coverage No. SCR000074.

9.5.3.4 Sanitary Wastewaters

ONS's sanitary wastewater system is tied into the Oconee Joint Regional Sewer Authority's system. The onsite Outfall 003 that previously discharged treated wastewater was eliminated effective December 1, 2010. ONS holds a discharge permit No. IW-000003 with the Oconee Joint Regional Sewer Authority and operates in compliance with the permit's requirements. ONS received a warning notification from the Oconee Joint Regional Sewer Authority for not notifying the authority 24 hours in advance of a sampling event. Duke Energy implemented corrective actions and complied with the letter's requirement to provide written notification of corrective actions.

9.5.3.5 Spill Prevention, Control, and Countermeasures

The EPA's Oil Pollution Prevention Rule became effective January 10, 1974, and was published under the authority of Section 311(j)(1)(C) of the Federal Water Pollution Control Act. The regulation has been published in 40 CFR 112, and facilities subject to the rule must prepare and implement an SPCC plan to prevent any discharge of oil into or upon navigable waters of the United States or adjoining shorelines. ONS is subject to this rule and has a written SPCC plan that identifies and describes the procedures, materials, equipment, and facilities utilized at the station to minimize the frequency and severity of oil spills in order to meet the requirements of this rule.

9.5.3.6 Reportable Spills [40 CFR 110]

ONS is subject to the reporting provisions of 40 CFR 110 as it relates to the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Federal Water Pollution Control Act. Any discharges of oil in such quantities that may be harmful to the public health or welfare or the environment must be reported to the U.S. Coast Guard (USCG) National Response Center. Based on review of site records from 2014–October 2020, two spills were reported to the National Response Center. The spills are attributable to Keowee Hydro operations rather than ONS operations. The first spill involved the release of appropriately 5 gallons of lubricating oil from the Keowee Hydro Station to the Keowee tailrace on July 20, 2014. The second spill involved the release of appropriately 4 ounces of hydraulic oil while testing a submersible hydraulic pump adjacent to the Keowee Hydro Station spillway on February 8, 2018.

9.5.3.7 Facility Response Plan

ONS is not subject to the facility response plan risk requirements described in 40 CFR 112.20 because the facility does not transfer oil over water to or from vessels and does not store oil in quantities greater than one million gallons. A certification that ONS does not meet these criteria is included in Appendix A of the ONS SPCC plan.

9.5.3.8 Section 404 Permit

Currently, ONS does not have any Section 404 permits in place because ONS does not have any dredge and fill activities. However, ONS would comply with regulatory requirements imposed by the USACE under Section 404 of the CWA as it relates to performing future activities in federal jurisdictional waters when appropriate.

9.5.4 Safe Drinking Water Act

ONS receives its potable water supply from municipal sources and does not have an active well subject to the Safe Drinking Water Act limits.

9.5.5 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species that are listed, or proposed for listing, as endangered or threatened. Depending on the action involved, the ESA requires consultation with the USFWS, and with the NMFS if marine or anadromous species could be affected. Although Duke Energy invited comment from the USFWS (Attachment C) during the development of this ER, a more structured consultation process with the agency may be initiated by the NRC per Section 7 of the ESA.

9.5.6 Migratory Bird Treaty Act

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed, and grants protection to any bird parts, including feathers, eggs, and nests. Currently, Duke Energy

maintains a migratory bird SPUT depredation permit and a corresponding depredation permit with the SCDNR (see Table 9.1-1).

9.5.7 Bald and Golden Eagle Protection Act

The BGEPA prohibits the take, transport, sale, barter, trade, import and export, and possession of bald and golden eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without a USFWS permit. As discussed in Section 3.7.8.1.1, bald eagles are not known to nest on the ONS site; however, activities on the ONS site are evaluated to ensure compliance under the BGEPA and MBTA. When necessary, consultation with responsible agencies is conducted. There are currently no BGEPA permitting requirements associated with ONS operations.

9.5.8 Magnuson-Stevens Fishery Conservation and Management Act

As discussed in Section 3.7.8.5, no EFH exists at Lake Keowee. No HAPCs or EFH areas protected from fishing are located on or adjacent to ONS. Therefore, there are no Magnuson-Stevens Fishery Conservation and Management Act restrictions applicable to ONS operations.

9.5.9 Marine Mammal Protection Act

The Marine Mammal Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. There are currently no Marine Mammal Protection Act permitting requirements associated with ONS operations.

9.5.10 Coastal Zone Management Act

The Federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on an applicant for a federal license to conduct an activity that could affect a state's coastal zone. The act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program ([16 USC 1456(c)(3)(A)]). South Carolina has a federally approved coastal management program and an SLR is a new federal action which triggers the requirement for a certification. ONS, located in Oconee County, is not within the South Carolina coastal zone.

9.5.11 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to determine whether the operation of the project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. No waterbodies at or adjacent to ONS or Lake Keowee have been designated a wild and scenic river. (NWSRS 2019)

9.5.12 National Historic Preservation Act

Section 106 of the NHPA [54 USC 306108] requires federal agencies having the authority to license any undertaking, prior to issuing the license, to consider the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any SHPO to substitute state review for council review [35 CFR 800.7]. Although not required of an applicant by federal law or NRC regulation, to provide early consultation for the Section 106 process, Duke Energy contacted the South Carolina Department of Archives and History for informal consultation concerning the ONS SLR and potential effects on cultural resources within the approximately 510-acre site and on historic properties within a 6-mile radius of ONS (Attachment D). Native American groups recognized as potential stakeholders were also consulted by Duke Energy with the opportunity for comment (Attachment D). Furthermore, as discussed in Section 3.8.6, Duke Energy has a cultural resources program in place to protect known cultural resources, as well as unknown cultural resources, by establishing a process for all activities that have the potential to impact historic resources.

9.5.13 Resource Conservation and Recovery Act

9.5.13.1 Nonradioactive Waste

As a generator of hazardous and nonhazardous wastes, ONS is subject to and complies with the RCRA and specific SCDHEC regulations contained in SC R. 61-79 and 61-107. ONS is classified as a small quantity generator of hazardous waste. As a generator of hazardous waste, ONS also maintains a hazardous waste generator identification number (Table 9.1-1). The SCDHEC hazardous waste regulations compliance inspection in April 2018 noted deficiencies. Duke Energy implemented corrective actions and a CEI/follow-up review letter was issued by the SCDHEC in June 2018 stating that all deficiencies previously noted had been corrected and that ONS was considered to be in compliance.

9.5.13.2 Reportable Spills [40 CFR 262]

ONS is subject to the reporting provisions of 40 CFR 262.34(d)(5)(iv)(C) as it relates to a fire, explosion, or other release of hazardous waste which could threaten human health outside the facility boundary or when the facility has knowledge that a spill has reached surface water. Any such events must be reported to the USCG National Response Center. Based on review of site records from 2014–October 2020, no reportable spills of hazardous waste have occurred.

9.5.13.3 Mixed Waste

Radioactive materials are regulated by the NRC under the AEA of 1954, and hazardous waste is regulated by the EPA under the RCRA of 1976. ONS rarely generates mixed waste. Duke Energy has a conditional exemption for low-level mixed waste in accordance with 40 CFR 266, Subpart N, in place for any low-level mixed waste placed in storage at ONS storage units listed under the exemption. If generated, low-level mixed waste would be managed onsite in accordance with NRC regulations and the conditional exemption requirements.

9.5.13.4 Underground Storage Tanks [SC R. 61-92]

ONS has eight USTs onsite. One 550-gallon UST stores waste oil and seven USTs ranging from 1,000-gallon to 12,000-gallon capacity are located at the onsite garage. The USTs contain motor oil, waste oil, gasoline, and diesel fuel, and are licensed with the SCDHEC Division of UST Management.

9.5.13.5 Aboveground Storage Tanks (SC Regulations)

South Carolina does not regulate aboveground storage tanks (SCDHEC 2019c).

9.5.13.6 Reportable Spills [SC R. 61-92.280.60]

ONS is subject to the reporting provisions of the SC R. 61-92.280.60 for reporting the release of a regulated substance from a UST containing a petroleum product or hazardous substance. Any such events must be reported to the SCDHEC. Based on review of site records from 2014–October 2020, no reportable UST releases of hazardous substances or petroleum products requiring reporting under this regulation have occurred.

9.5.14 Pollution Prevention Act

In accordance with RCRA Section 3002(b) and 40 CFR 262.27, a small or large quantity generator must certify to the appropriate statement on the uniform hazardous waste manifest required to accompany each hazardous waste shipment that there is a waste minimization program. ONS meets this requirement, as procedural measures are in place to minimize hazardous waste generated to the maximum extent practical.

9.5.15 Federal Insecticide, Fungicide and Rodenticide Act

Commercially available EPA-registered herbicides, insecticides, and rodenticides are applied by licensed employees or contractors. Duke Energy has developed corporate guidance on pesticide management that includes the requirement that only persons who have obtained a license as specified in the applicable state regulations can conduct insecticide, herbicide, or rodenticides applications onsite. ONS is in compliance with the requirements of this act.

9.5.16 Toxic Substances Control Act

The Toxic Substances Control Act of 1976 regulates polychlorinated biphenyls (PCBs) [40 CFR 761] and asbestos [40 CFR 763]. ONS does not have any transformers with capacitors that contain PCBs in storage onsite. Fluorescent lamp ballasts manufactured prior to the PCB ban in 1979 could include PCBs. Duke Energy waste management guidance includes the management of lamps not marked as non-PCB. Asbestos removal activities and subsequent storage and disposal are managed in accordance with SC R. 61-86.1. Asbestos work at ONS is conducted by both Duke Energy employees and by contractors. All individuals performing asbestos work at ONS must have their names listed on the current group license for ONS to be able to perform asbestos work. Duke Energy's corporate asbestos management program provides guidance on the management and storage of asbestos. The SCDHEC authorizes

disposal sites for asbestos in quarterly abatement reports. ONS is in compliance with all PCB and asbestos regulations applicable to the facility.

9.5.17 Hazardous Materials Transportation Act

Because ONS ships hazardous materials that are regulated by the U.S. Department of Transportation offsite, the facility is subject to and complies with the applicable requirements of the Hazardous Materials Transportation Act described in Title 49 of the CFR, including the requirement to possess a current hazardous materials certificate of registration (Table 9.1-1).

9.5.18 Emergency Planning and Community Right-to-Know Act

ONS is subject to and complies with Section 312 of the Emergency Planning and Community Right-to-Know Act that requires annual submittal of an emergency and hazardous chemical inventory report (Tier II) to the local emergency planning commission, the state emergency response committee, and the local fire department. As required by the SCDHEC, ONS submits its report electronically through the E-Plan system. The 2018 report for ONS lists argon, lead acid batteries, boric acid, refrigerated liquid carbon dioxide, hydrazine products, chlorine, carbohydrazide, diesel fuel, treated wood, electrolyte, cadmium batteries, abrasive grains and powders, liquid nitrogen, caustic soda, sulfuric acid, trisodium phosphate, resins, used oil, gasoline, and other chemicals.

9.5.19 Comprehensive Environmental Response, Compensation, and Liability Act

ONS is subject to the hazardous substance release and reporting provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as subsequently amended. Any release of reportable quantities of listed hazardous substances to the environment requires a notification to the USCG National Response Center, the SCDHEC, and the SC Emergency Management Division, as appropriate, and subsequent written follow-up within 15 days of the release. Based on a review of records over the 5-year period from 2014–2018, there have been no releases at ONS that have triggered this notification requirement.

9.5.20 Farmland Protection Policy Act

The FPPA only applies to federal programs. The term "federal program" under this act does not include federal permitting or licensing for activities on private or non-federal lands. Therefore, because license renewal is considered a federal licensing activity and ONS is located on non-federal lands, the FPPA is not applicable.

9.5.21 Federal Aviation Act

Coordination with the FAA is required when it becomes necessary to ensure that the highest structures associated with a project do not impair the safety of aviation. Submission of a letter of notification (with accompanying maps and project description) to the FAA would result in a

written response from the FAA certifying that no hazard exists or recommending project changes and/or the installation of warning devices such as lighting. No license renewal-related construction activities have been identified; therefore, no new notifications to the FAA are required.

9.5.22 Occupational Safety and Health Act

OSHA governs the occupational safety and health of construction workers and operations staff. ONS and its contractors comply with OSHA's requirements, as these are incorporated in the site's occupational health and safety practices.

9.5.23 State Water Use Program

ONS was issued a surface water withdrawal permit (Permit No. 37PN001) by the State of South Carolina. As a condition of the permit, ONS must comply with the reporting requirements in SC R. 61-119 and report withdrawals to the state on an annual basis. ONS withdraws surface water and reports withdrawal amounts annually in compliance with these permit requirements.

9.5.24 Oconee County Zoning Requirements

As discussed in Section 3.2.1, the ONS site is in a control-free zone of Oconee County, SC. Duke Energy is responsible for supervising and managing development at ONS and the surrounding Keowee-Jocassee area.

9.6 Environmental Reviews

Duke Energy has environmental guidance in place to ensure that projects and activities are reviewed prior to implementation to determine any potential environmental impacts. Specific procedures/plans are in place for environmental review, land-disturbing activities, work in wetland areas, and avian protection. This guidance, along with use of an environmental checklist, ensures that prior to the activity:

- Appropriate local, state, and/or federal permits are obtained or modified as necessary.
- BMPs, including for stormwater, are implemented to protect wetlands and other sensitive ecosystems.
- Appropriate agencies are consulted on matters involving federally and state-listed threatened, endangered, and protected species; BMPs are implemented to minimize impacts to these species.
- Appropriate agencies are consulted on matters involving cultural resources and to ensure BMPs are implemented to minimize impacts to this resource.

In summary, Duke Energy's administrative controls ensure that appropriate local, state, and/or federal permits are obtained or modified as necessary, that cultural resources and threatened

and endangered species are protected if present, and that other regulatory issues are adequately addressed as necessary.

9.7 Alternatives

The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements. [10 CFR 51.45(d)]

No-action alternatives are discussed in Chapter 7. In the event that the NRC does not issue a subsequent renewed license for ONS and one of the no-action alternatives were implemented, the alternate generating facilities could be constructed and operated to comply with applicable environmental quality standards and regulations.

10.0 REFERENCES

61 FR 28483. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule. *Federal Register* Volume 61:28467-28497. June 5, 1996.

69 FR 52040. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register* Volume 69:52040. August 24, 2004.

78 FR 37282. Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. Final rule. *Federal Register* 78:37282. June 20, 2013.

79 FR 56041. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List *Symphyotrichum georgianum* as an Endangered or Threatened Species. *Federal Register* 79:56041. September 18, 2014.

81 FR 24707. Endangered and Threatened Wildlife and Plants; Determination That Designation of Critical Habitat is Not Prudent for the Northern Long-Eared Bat. U.S. Department of the Interior, Fish and Wildlife Service. *Federal Register* 81:24707. April 27, 2016.

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Attachment A: NRC NEPA Issues for License Renewal

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Oconee Nuclear Station Environmental Report

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Duke Energy has prepared this environmental report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. The NRC included in the regulation the list of 78 National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR Part 51, Table B-1).

The following table lists the 78 issues from 10 CFR Part 51, Appendix B, Table B-1, and identifies the section in this environmental report in which Duke Energy addresses each issue.

Table A-1. Oconee Nuclear Station Environmental Report Cross-Reference of License Renewal NEPA Issues

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Land Use			
1	Onsite land use	1	4.1.1	4.2.1.1/4-6
2	Offsite land use	1	4.1.2	4.2.1.1/4-7
3	Offsite land use in transmission line rights-of-way	1	4.0.1	4.2.1.1/4-6
	Visual Resources			
4	Aesthetic impacts	1	4.1.3	4.2.1.2/4-9
	Air Quality			
5	Air quality (all plants)	1	4.2.1	4.3.1.1/4-14
6	Air quality effects of transmission lines	1	4.2.2	4.3.1.1/4-14
	Noise			
7	Noise impacts	1	4.3	4.3.1.2/4-19
	Geologic Impacts			
8	Geology and soils	1	4.4	4.4/4-29
	Surface Water Resources			
9	Surface water use and quality (non-cooling system impacts)	1	4.0.1/5.2	4.5.1.1/4-30
10	Altered current patterns at intake and discharge structures	1	4.0.1/5.2	4.5.1.1/4-36
11	Altered salinity gradients	1	4.0.1	4.5.1.1/4-36
12	Altered thermal stratification of lakes	1	4.0.1/5.2	4.5.1.1/4-37
13	Scouring caused by discharged cooling water	1	4.0.1/5.2	4.5.1.1/4-38
14	Discharge of metals in cooling system effluent	1	4.0.1/5.2	4.5.1.1/4-38
15	Discharge of biocides, sanitary wastes, and minor chemical spills	1	4.0.1/5.2	4.5.1.1/4-39
16	Surface water use conflicts (plants with once-through cooling systems)	1	4.0.1/5.2	4.5.1.1/4-40
17	Surface water use conflicts (plants with cooling ponds, or cooling towers using makeup water from a river)	2	4.5.1	4.5.1.1/4-41

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
18	Effects of dredging on surface water quality	1	4.0.1/5.2	4.5.1.1/4-42
19	Temperature effects on sediment transport capacity	1	4.0.1/5.2	4.5.1.1/4-43
	Groundwater Resources			
20	Groundwater contamination and use (non-cooling system impacts)	1	4.0.1/5.2	4.5.1.2/4-45
21	Groundwater use conflicts (plants that withdraw <100 gpm)	1	4.0.1/5.2	4.5.1.2/4-47
22	Groundwater use conflicts (plants that withdraw >100 gpm)	2	4.5.3	4.5.1.2/4-48
23	Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	2	4.5.2	4.5.1.2/4-48
24	Groundwater quality degradation resulting from water withdrawals	1	4.0.1/5.2	4.5.1.2/4-49
25	Groundwater quality degradation (plants with cooling ponds in salt marshes)	1	4.0.1	4.5.1.2/4-50
26	Groundwater quality degradation (plants with cooling ponds at inland sites)	2	4.5.4	4.5.1.2/4-51
27	Radionuclides released to groundwater	2	4.5.5	4.5.1.2/4-51
	Terrestrial Resources			
28	Effects on terrestrial resources (non-cooling system impacts)	2	4.6.5	4.6.1.1/4-59
29	Exposure of terrestrial organism to radionuclides	1	4.0.1/5.2	4.6.1.1/4-61
30	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	1	4.0.1/5.2	4.6.1.1/4-64
31	Cooling tower impacts on vegetation (plants with cooling towers)	1	4.0.1	4.6.1.1/4-69
32	Bird collisions with plant structures and transmission lines	1	4.0.1/5.2	4.6.1.1/4-70
33	Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.4	4.6.1.1/4-75
34	Transmission line ROW management impacts on terrestrial resources	1	4.0.1/5.2	4.6.1.1/4-75

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
35	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0.1/5.2	4.6.1.1/4-80
	Aquatic Resources			
36	Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.1	4.6.1.2/4-87
37	Impingement and entrainment of aquatic organisms (plants with cooling towers)	1	4.0.1	4.6.1.2/4-92
38	Entrainment of phytoplankton and zooplankton (all plants)	1	4.0.1/5.2	4.6.1.2/4-93
39	Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.2	4.6.1.2/4-94
40	Thermal impacts on aquatic organisms (plants with cooling towers)	1	4.0.1	4.6.1.2/4-96
41	Infrequently reported thermal impacts (all plants)	1	4.0.1/5.2	4.6.1.2/4-97
42	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	1	4.0.1/5.2	4.6.1.2/4-100
43	Effects of non-radiological contaminants on aquatic organisms	1	4.0.1/5.2	4.6.1.2/4-103
44	Exposure of aquatic organisms to radionuclides	1	4.0.1/5.2	4.6.1.2/4-105
45	Effect of dredging on aquatic organisms	1	4.0.1/5.2	4.6.1.2/4-107
46	Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.3	4.6.1.2/4-109
47	Effects on aquatic resources (non-cooling system impacts)	1	4.0.1/5.2	4.6.1.2/4-110
48	Impacts of transmission line ROW management on aquatic resources	1	4.0.1/5.2	4.6.1.2/4-112
49	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses	1	4.0.1/5.2	4.6.1.2/4-110
	Special Status Species and Habitats			
50	Threatened, endangered, and protected species and essential fish habitat	2	4.6.6	4.6.1.3/4-115
	Historic and Cultural Resources			
51	Historic and cultural resources	2	4.7	4.7.1/4-122

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Socioeconomics			
52	Employment and income, recreation and tourism	1	4.8.1	4.8.1.1/4-127
53	Tax revenues	1	4.8.2	4.8.1.1/4-128
54	Community services and education	1	4.8.3	4.8.1.1/4-129
55	Population and housing	1	4.8.4	4.8.1.1/4-130
56	Transportation	1	4.8.5	4.8.1.1/4-131
	Human Health			
57	Radiation exposures to the public	1	4.0.1/5.2	4.9.1.1.1/4-140
58	Radiation exposures to plant workers	1	4.0.1/5.2	4.9.1.1.1/4-136
59	Human health impacts from chemicals	1	4.0.1/5.2	4.9.1.1.2/4-147
60	Microbiological hazards to the public (plants that use cooling ponds, lake, or canals or that discharge to a river)[c]	2	4.9.1	4.9.1.1.3/4-149
61	Microbiological hazards to plant workers	1	4.0.1/5.2	4.9.1.1.3/4-149
62	Chronic effects of electromagnetic fields	UC	4.0.3	4.9.1.1.4/4-150
63	Physical occupational hazards	1	4.0.1/5.2	4.9.1.1.5/4-156
64	Electric shock hazards	2	4.9.2	4.9.1.1.5/4-156
	Postulated Accidents			
65	Design-basis accidents	1	4.0.1/5.2	4.9.1.2/4-158
66	Severe accidents	2	4.15	4.9.1.2/4-158
	Environmental Justice			
67	Minority and low-income populations	2	4.10.1	4.10.1/4-167
	Waste Management			
68	Low-level waste storage and disposal	1	4.11.1	4.11.1.1/4-171
69	Onsite storage of spent nuclear fuel	1	4.11.2	4.11.1.2/4-172
70	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	1	4.11.3	4.11.1.3/4-175
71	Mixed waste storage and disposal	1	4.11.4	4.11.1.4/4-178
72	Non-radioactive waste storage and disposal	1	4.11.5	4.11.1.5/4-179

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Cumulative Impacts			
73	Cumulative impacts	2	4.12	4.13/4-243
	Uranium Fuel Cycle			
74	Offsite radiological impacts–individual impacts from other than the disposal of spent fuel and high-level waste	1[d]	4.13.1	4.12.1.1/4-193
75	Offsite radiological impacts–collective impacts from other than the disposal of spent fuel and high-level waste	1	4.13.2	4.12.1.1/4-194
76	Non-radiological Impacts of the uranium fuel cycle	1	4.13.3	4.12.1.1/4-194
77	Transportation	1	4.13.4	4.12.1.1/4-196
	Termination of Nuclear Power Plant Operations and Decommissioning			
78	Termination of plant operations and decommissioning	1	4.14	4.12.2.1/4-201

a. 10 CFR 51, Subpart A, Appendix A, Table B-1 (issue numbers added to facilitate discussion).

b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437, Rev 1).

c. Wording from [10 CFR 51.53(c)(3)(ii)(G)].

d. SECY-14-0072 (July 21, 2014).

UC = uncategorized (categorization and impact finding definitions do not apply to the issue).

Attachment B: ONS NPDES Permit

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

National Pollutant Discharge Elimination System Permit

for Discharge to Surface Waters

This Permit Certifies That

Duke Energy Carolinas LLC
Oconee Nuclear Station

has been granted permission to discharge from a facility located at

7800 Rochester Highway
Seneca, SC
Oconee County

to receiving waters named

001 - Lake Keowee
002, 004, 007 - Keowee River

in accordance with limitations, monitoring requirements and other conditions set forth herein. This permit is issued in accordance with the provisions of the Pollution Control Act of South Carolina (S.C. Code Sections 48-1-10 *et seq.*, 1976), Regulation 61-9 and with the provisions of the Federal Clean Water Act (PL 92-500), as amended, 33 U.S.C. 1251 *et seq.*, the "Act."

Jeffrey P. deBessonet, P.E., Director
Water Facilities Permitting Division

Issue Date: **March 30, 2010**

Expiration Date: **September 30, 2013**

Effective Date: **May 1, 2010**

Permit No.: **SC0000515**

Modification Issue Date: **June 1, 2011**

Modification Effective Date: **July 1, 2011**

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PART I. Definitions

Any term not defined in this Part has the definition stated in the Pollution Control Act or in "Water Pollution Control Permits", R.61-9 or its normal meaning.

A. The "Act", or CWA, shall refer to the Clean Water Act (Formerly referred to as the Federal Water Pollution Control Act) Public Law 92-500, as amended.

B. The "average" or "arithmetic mean" of any set of values is the summation of the individual values divided by the number of individual values.

C. "Basin" (or "Lagoon") means any in-ground or earthen structure designed to receive, treat, store, temporarily retain and/or allow for the infiltration/evaporation of wastewater.

D. "Blowdown" means the minimum discharge of recirculating water for the purpose of discharging materials contained in the water, the further buildup of which would cause concentration in amounts exceeding limits established by best engineering practices.

E. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

F. "Chemical metal cleaning waste" means any wastewater resulting from the cleaning of any metal process equipment with chemical compounds, including, but not limited to, boiler tube cleaning (40 CFR 423.11(c)).

G. A "composite sample" shall be defined as one of the following four types:

1. An influent or effluent portion collected continuously over a specified period of time at a rate proportional to the flow.

2. A combination of not less than 8 influent or effluent grab samples collected at regular (equal) intervals over a specified period of time and composited by increasing the volume of each aliquot in proportion to flow. If continuous flow measurement is not used to composite in proportion to flow, the following method will be used: An instantaneous flow measurement should be taken each time a grab sample is collected. At the end of the sampling period, the instantaneous flow measurements should be summed to obtain a total flow. The instantaneous flow measurement can then be divided by the total flow to determine the percentage of each grab sample to be combined. These combined samples form the composite sample.

3. A combination of not less than 8 influent or effluent grab samples of equal volume but at variable time intervals that are inversely proportional to the volume of the flow. In other words, the time interval between aliquots is reduced as the volume of flow increases.

4. If the effluent flow varies by less than 15 percent, a combination of not less than 8 influent or effluent grab samples of constant (equal) volume collected at regular (equal) time intervals over a specified period of time.

All samples shall be properly preserved in accordance with Part II.J.4. Continuous flow or the sum of instantaneous flows measured and averaged for the specified compositing time period shall be used with composite results to calculate mass.

H. "Daily discharge" means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant over the day.

I. "Daily maximum" is the highest average value recorded of samples collected on any single day during the calendar month.

J. "Daily minimum" is the lowest average value recorded of samples collected on any single day during the calendar month.

K. The "Department" or "DHEC" shall refer to the South Carolina Department of Health and Environmental Control.

L. The "geometric mean" of any set of values is the Nth root of the product of the individual values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

M. A "grab sample" is an individual, discrete or single influent or effluent portion of at least 100 milliliters collected at a time representative of the discharge and over a period not exceeding 15 minutes and retained separately for analysis.

N. "Groundwater" means the water below the land surface found in fractured rock or various soil strata.

O. "Hydroelectric wastewaters" means any wastewater consistent with the operation of a hydroelectric station. These wastewaters have been divided into two categories:

a. Equipment-related cooling waters: This category incorporate discharges of non-contact cooling water used in cooling the bearings, lube oil coolers, air compressors, generators, power transformers, air conditioners, and rheostats, direct contact cooling water, and other similar waters as approved by the Department.

b. Equipment maintenance and floor drain waters: This category include discharges from the followings: floor drains, trench drains, station sumps, sump drains, miscellaneous drainage waters collected in a sump (groundwater infiltration, surface water seepage, tunnel pumpage), various drains (wheel pit drains, gate stem, turbine access door, scroll case access door), leakages (turbine leakage, penstock housing leakage, packing boxes leakage), bearing related waters (lower guide bearing drains, bearing seal leakage, bearing water seal, bearing lubrication water), compressor blow down, storm water runoff from transformers containment areas, switch yards and roof drains and other similar waters as approved by the Department. At some facilities, the equipment and floor drain waters include effluents from treatment units such as oil/water separators, oil flotation wells, or station sumps functioning as oil/water separators.

P. "Low volume waste sources" include, but are not limited to: wastewaters from wet scrubber air pollution control systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house service water systems. Sanitary and air conditioning wastes are not included (40 CFR 423.11(b)).

Q. The "maximum or minimum" is the highest or lowest value, respectively, recorded of all samples collected during the calendar month. These terms may also be known as the instantaneous maximum or minimum.

R. "Metal cleaning waste" means any wastewater resulting from cleaning [with or without chemical cleaning compounds] any metal process equipment including, but not limited to, boiler tube cleaning, boiler fireside cleaning, and air preheater cleaning (40 CFR 423.11(d)).

S. "Monitoring well" means any well used to sample groundwater for water quality analysis or to measure groundwater levels.

T. The "monthly average", other than for fecal coliform and enterococci, is the arithmetic mean of all samples collected in a calendar month period. The monthly average for fecal coliform and enterococci bacteria is the geometric mean of all samples collected in a calendar month period. The monthly average loading is the arithmetic average of all daily discharges made during the month.

U. "Once through cooling water" means water passed through the main cooling condensers in one or two passes for the purpose of removing waste heat (40 CFR 423.11(g)).

V. The "PCA" shall refer to the Pollution Control Act (Chapter 1, Title 48, Code of Laws of South Carolina).

W. The "practical quantitation limit" (PQL) is the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. It is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method-specific sample weights, volumes, and processing steps have been followed. It is also referred to as the reporting limit.

X. "Quarter" is defined as the first three calendar months beginning with January and each group of three calendar months thereafter (also known as calendar quarters).

Y. "Quarterly average" is the arithmetic mean of all samples collected in a quarter.

Z. "Recirculated cooling water" means water which is passed through the main condensers for the purpose of removing waste heat, passed through a cooling device for the purpose of removing such heat from the water then passed again, except for blowdown, through the main condenser (40 CFR 423.11(h)).

AA. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

BB. "Sludge" means industrial sludge. Industrial sludge is a solid, semi-solid, or liquid residue generated during the treatment of industrial wastewater in a treatment works. Industrial sludge includes, but is not limited to, industrial septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from industrial sludge. Industrial sludge does not include ash generated during the firing of industrial sludge in an industrial sludge incinerator or grit and screenings generated during preliminary treatment of industrial wastewater in a treatment works. Industrial sludge by definition does not include sludge covered under 40 CFR Part 503 or R.61-9.503.

CC. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

DD. "Wastewater" means industrial wastewater. Industrial wastewater is wastewater generated from a federal facility, commercial or industrial process, including waste and wastewater from humans when generated at an industrial facility.

PART II. Standard Conditions

A. Duty to comply

The permittee must comply with all conditions of the permit. Any permit noncompliance constitutes a violation of the Clean Water Act and the Pollution Control Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. The Department's approval of wastewater facility plans and specifications does not relieve the permittee of responsibility to meet permit limits.

1. The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if the permit has not yet been modified to incorporate the requirement.

2. Failure to comply with permit conditions or the provisions of this permit may subject the permittee to civil penalties under S.C. Code Section 48-1-330 or criminal sanctions under S.C. Code Section 48-1-320. Sanctions for violations of the Federal Clean Water Act may be imposed in accordance with the provisions of 40 CFR Part 122.41(a)(2) and (3).

3. A person who violates any provision of this permit, a term, condition or schedule of compliance contained within this NPDES permit, or the State law is subject to the actions defined in the State law.

B. Duty to reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. A permittee with a currently effective permit shall submit a new application 180 days before the existing permit expires, unless permission for a later date has been granted by the Department. The Department shall not grant permission for applications to be submitted later than the expiration date of the existing permit.

C. Need to halt or reduce activity not a defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper operation and maintenance

1. The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes effective performance based on design facility removals, adequate funding, adequate operator staffing and training and also includes adequate laboratory controls and appropriate quality assurance

procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Power Failures. In order to maintain compliance with effluent limitations and prohibitions of this permit, the permittee shall either:

   a. provide an alternative power source sufficient to operate the wastewater control facilities;

   b. or have a plan of operation which will halt, reduce, or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

3. The permittee shall develop and maintain at the facility a complete Operations and Maintenance Manual for the waste treatment facilities. The manual shall be made available for on-site review during normal working hours. The manual shall contain operation and maintenance instructions for all equipment and appurtenances associated with the waste treatment facilities and land application system, if applicable. The manual shall contain a general description of the treatment process(es), the operational procedures to meet the requirements of E.1 above, and the corrective action to be taken should operating difficulties be encountered.

4. The permittee shall provide for the performance of daily treatment facility inspections by a certified operator of the appropriate grade as defined in Part V.E of this permit. The Department may make exceptions to the daily operator requirement in accordance with R.61-9.122.41(e)(3)(ii). The inspections shall include, but should not necessarily be limited to, areas which require visual observation to determine efficient operation and for which immediate corrective measures can be taken using the O & M manual as a guide. All inspections shall be recorded and shall include the date, time, and name of the person making the inspection, corrective measures taken, and routine equipment maintenance, repair, or replacement performed. The permittee shall maintain all records of inspections at the permitted facility as required by the permit, and the records shall be made available for on-site review during normal working hours.

5. The name and grade of the operator of record shall be submitted to DHEC/Bureau of Water/Water Pollution Control Division prior to placing the facility into operation. A roster of operators associated with the facility's operation and their certification grades shall also be submitted with the name of the "operator-in-charge." Any changes in operator or operators shall be submitted to the Department as they occur.

F. Permit actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

G. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege nor does it authorize any injury to persons or property or invasion of other private rights, or any infringement of State or local law or regulations.

H. Duty to provide information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

I. Inspection and entry

The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the Department), upon presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act and Pollution Control Act, any substances or parameters at any location.

J. Monitoring and records

1. a. (1) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(2) Samples shall be reasonably distributed in time, while maintaining representative sampling.

(3) No analysis, which is otherwise valid, shall be terminated for the purpose of preventing the analysis from showing a permit or water quality violation.

b. Flow Measurements.

(1) Where primary flow meters are required, appropriate flow measurement devices and methods consistent with accepted scientific practices shall be present and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to ensure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than □ 10% from the true discharge rates throughout the range of expected discharge volumes. The primary flow device, where required, must be accessible to the use of a continuous flow recorder.

(2) Where permits require an estimate of flow, the permittee shall maintain at the permitted facility a record of the method(s) used in estimating the discharge flow (e.g., pump curves, production charts, water use records) for the outfall(s) designated on limits pages to monitor flow by an estimate.

(3) Records of any necessary calibrations must be kept.

2. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by R.61-9.503 or R.61-9.504), the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Department at any time.

3. Records of monitoring information shall include:

   a. The date, exact place, and time of sampling or measurements;
   b. The individual(s) who performed the sampling or measurements;
   c. The date(s) analyses were performed;
   d. The individual(s) who performed the analyses;
   e. The analytical techniques or methods used; and
   f. The results of such analyses.

4. a. Analyses for required monitoring must be conducted according to test procedures approved under 40 CFR Part 136, equivalent test procedures approved by the Department or other test procedures that have been specified in the permit.

   In the case of sludge use or disposal, analysis for required monitoring must be conducted according to test procedures approved under 40 CFR Part 136, test procedures specified in R.61-9.503 or R.61-9.504, equivalent test procedures approved by the Department or other test procedures that have been specified in the permit.

   b. Unless addressed elsewhere in this permit, the permittee shall use a sufficiently sensitive analytical method that achieves a value below the derived permit limit stated in Part III. If more than one method of analysis is approved for use, the Department recommends for reasonable potential determinations that the permittee use the method having the lowest practical quantitation limit (PQL) unless otherwise specified in Part V of the permit. For the purposes of reporting analytical data on the Discharge Monitoring Report (DMR):

      (1) Analytical results below the PQL conducted using a method in accordance with Part II.J.4.a above shall be reported as zero (0). Zero (0) shall also be used to average results which are below the PQL. When zero (0) is reported or used to average results, the permittee shall report, in the "Comment Section" or in an attachment to the DMR, the analytical method used, the PQL achieved, and the number of times results below the PQL were reported as zero (0).

      (2) Analytical results above the PQL conducted using a method in accordance with Part II.J.4.a shall be reported as the value achieved. When averaging results using a value containing a "less than," the average shall be calculated using the value and reported as "less than" the average of all results collected.

(3)(a) The mass value for a pollutant collected using a grab sample shall be calculated using the 24-hour totalized flow for the day the sample was collected (if available) or the instantaneous flow at the time of the sample and either the concentration value actually achieved or the value as determined from the procedures in (1) or (2) above, as appropriate. Grab samples should be collected at a time representative of the discharge.

(b) The mass value for a pollutant collected using a composite sample shall be calculated using the 24-hour totalized flow measured for the day the sample was collected and either the concentration value actually achieved or the value as determined from the procedures in (1) or (2) above, as appropriate.

5. The PCA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $25,000 or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment provided by the Clean Water Act is also by imprisonment of not more than 4 years.

K. Signatory requirement.

1. All applications, reports, or information submitted to the Department shall be signed and certified.

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

(a) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or

(b) The manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency or public facility: By either a principal executive officer, mayor, or other duly authorized employee or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:

(a) The chief executive officer of the agency, or

(b) A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator, Region IV, EPA).

b. All reports required by permits, and other information requested by the Department, shall be signed by a person described in Part II.K.1.a of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in Part II.K.I.a of this section;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) and,

(3) The written authorization is submitted to the Department.

c. Changes to authorization. If an authorization under Part II.K.1.b of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part II.K.1.b of this section must be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under Part II.K.1.a or b of this section shall make the following certification: "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

2. The PCA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $25,000 per violation, or by imprisonment for not more than two years per violation, or by both.

L. Reporting requirements

1. Planned changes.

The permittee shall give written notice to DHEC/Bureau of Water/Water Facilities Permitting Division as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in R 61-9.122.29(b); or

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under Part II.L.8 of this section.

c. The alteration or addition results in a significant change in the permittee's sewage sludge or industrial sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan (included in the NPDES permit directly or by reference);

2. Anticipated noncompliance.

The permittee shall give advance notice to the DHEC/Bureau of Water/Water Pollution Control Division of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers.

This permit is not transferable to any person except after written notice to the DHEC/Bureau of Water/NPDES Administration. The Department may require modification or revocation and reissuance of the permit to change the name of permittee and incorporate such other requirements as may be necessary under the Pollution Control Act and the Clean Water Act.

a. Transfers by modification. Except as provided in paragraph b of this section, a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued (under R.61-9.122.62(e)(2)), or a minor modification made (under R.61-9.122.63(d)), to identify the new permittee and incorporate such other requirements as may be necessary under CWA.

b. Other transfers. As an alternative to transfers under paragraph a of this section, any NPDES permit may be transferred to a new permittee if:

(1) The current permittee notifies the Department at least 30 days in advance of the proposed transfer date in Part II.L.3.b(2) of this section;

(2) The notice includes U.S. EPA NPDES Application Form 1 and a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

(3) Permits are non-transferable except with prior consent of the Department. A modification under this section is a minor modification which does not require public notice.

4. Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

a. Monitoring results must be reported on a Discharge Monitoring Report (DMR) or forms provided or specified by the Department for reporting results of monitoring of sludge use or disposal practices including the following:

(1) Effluent Monitoring: Effluent monitoring results obtained at the required frequency shall be reported on a Discharge Monitoring Report Form (EPA Form 3320-1). The DMR is due postmarked no later than the 28th day of the month following the end of the monitoring period. One original and one copy of the Discharge Monitoring Reports (DMRs) shall be submitted to:

S.C. Department of Health and Environmental Control
Bureau of Water/Water Pollution Control Division
Data Management Section
2600 Bull Street
Columbia, South Carolina 29201

(2) Groundwater Monitoring: Groundwater monitoring results obtained at the required frequency shall be reported on a Groundwater Monitoring Report Form (DHEC 2110 or other form as approved by the Department) postmarked no later than the 28th day of the month following the end of the monitoring period. One original and one copy of the Groundwater Monitoring Report Form shall be submitted to:

S.C. Department of Health and Environmental Control
Bureau of Water/Water Monitoring, Assessment and Protection Division
Groundwater Management Section
2600 Bull Street
Columbia, South Carolina 29201

(3) Sludge, Biosolids and/or Soil Monitoring: Sludge, biosolids and/or soil monitoring results obtained at the required frequency shall be reported in a laboratory format as stated in Part V of the permit. Two copies of these results shall be submitted to:

S.C. Department of Health and Environmental Control
Bureau of Water/Water Pollution Control Division
Water Pollution Enforcement Section
2600 Bull Street
Columbia, South Carolina 29201

(4) All other reports required by this permit shall be submitted at the frequency specified elsewhere in the permit to:

S.C. Department of Health and Environmental Control
Bureau of Water/Water Pollution Control Division
Water Pollution Enforcement Section
2600 Bull Street
Columbia, South Carolina 29201

b. If the permittee monitors any pollutant more frequently than required by the permit using test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in R.61-9.503 or R.61-9.504, or as specified in the permit, all valid results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Department. The permittee has sole responsibility for scheduling analyses, other than for the sample date specified in Part V, so as to ensure there is sufficient opportunity to complete and report the required number of valid results for each monitoring period.

c. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Department in the permit.

5. Twenty-four hour reporting

a. The permittee shall report any non-compliance, which may endanger health or the environment. Any information shall be provided orally to local DHEC office within 24 hours from the time the permittee becomes aware of the circumstances. During normal working hours call:

County	EQC Region	Phone No.
Anderson, Oconee	Region 1- Anderson EQC Office	864-260-5569
Abbeville, Edgefield, Greenwood, Laurens, McCormick, Saluda	Region I – Greenwood EQC Office	864-223-0333
Greenville, Pickens	Region 2 – Greenville EQC Office	864-241-1090
Cherokee, Spartanburg, Union	Region 2 – Spartanburg EQC Office	864-596-3800
Fairfield, Lexington, Newberry, Richland	Region 3 –Columbia EQC Office	803-896-0620
Chester, Lancaster, York	Region 3 – Lancaster EQC Office	803-285-7461
Chesterfield, Darlington, Dillon, Florence, Marion, Marlboro	Region 4 – Florence EQC Office	843-661-4825
Clarendon, Kershaw, Lee, Sumter	Region 4 – Sumter EQC Office	803-778-6548
Aiken, Allendale, Bamberg, Barnwell, Calhoun, Orangeburg	Region 5 – Aiken EQC Office	803-641-7670
Georgetown, Horry, Williamsburg	Region 6 – Myrtle Beach EQC Office	843-238-4378
Berkeley, Charleston, Dorchester	Region 7 – Charleston EQC Office	843-953-0150
Beaufort, Colleton, Hampton, Jasper	Region 8 – Beaufort EQC Office	843-846-1030

*After-hour reporting should be made to the 24-Hour Emergency Response telephone number 803-253-6488 or 1-888-481-0125 outside of the Columbia area.

A written submission shall also be provided to the address in Part II.L.4.a(4) within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

b. The following shall be included as information which must be reported within 24 hours under this paragraph.

(1) Any unanticipated bypass which exceeds any effluent limitation in the permit. (See R.61-9.122.44(g)).

(2) Any upset which exceeds any effluent limitation in the permit.

(3) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Department in the permit to be reported within 24 hours (See R 61-9.122.44(g)). If the permit contains maximum limitations for any of the pollutants listed below, a violation of the maximum limitations shall be reported orally to the DHEC/Bureau of Water/Water Pollution Control Division within 24 hours or the next business day.

(a) Whole Effluent Toxicity (WET),
(b) tributyl tin (TBT), and
(c) any of the following bioaccumulative pollutants:

α BHC	Mercury
β BHC	Mirex
δ BHC (Lindane)	Octachlorostyrene
BHC	PCBs
Chlordane	Pentachlorobenzene
DDD	Photomirex
DDE	1,2,3,4-Tetrachlorobenzene
DDT	1,2,4,5-Tetrachlorobenzene
Dieldrin	2,3,7,8-TCDD
Hexachlorobenzene	Toxaphene
Hexachlorobutadiene	

c. The Department may waive the written report on a case-by-case basis for reports under Part II.L.5.b of this section if the oral report has been received within 24 hours.

6. Other noncompliance.

The permittee shall report all instances of noncompliance not reported under Part II.L.4 and 5 of this section and Part IV at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.L.5 of this section.

7. Other information.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information to the Water Facilities Permitting Division. This information may result in permit modification, revocation and reissuance, or termination in accordance with Regulation 61-9.

8. Existing manufacturing, commercial, mining, and silvicultural dischargers.

In addition to the reporting requirements under Part II.L.1-7 of this section, all existing manufacturing, commercial, mining, and silvicultural dischargers must notify the DHEC/Bureau of Water/Water Pollution Control Division of the Department as soon as they know or have reason to believe:

a. That any activity has occurred or will occur which would result in the discharge on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(1) One hundred micrograms per liter (100 µg/l);

(2) Two hundred micrograms per liter (200 µg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

(3) Five (5) times the maximum concentration value reported for that pollutant in the permit application; or

(4) The level established by the Department in accordance with section R.61-9.122.44(f).

b. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed in the highest of the following "notification levels":

(1) Five hundred micrograms per liter (500 µg/l);

(2) One milligram per liter (1 mg/l) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with R.61-9.122.21(g)(7).

(4) The level established by the Department in accordance with section R.61-9.122.44(f).

M. Bypass

1. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Part II.M.2 and 3 of this section.

2. Notice.

a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible, at least ten days before the date of the bypass to the DHEC/Bureau of Water/ Water Facilities Permitting Division.

b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II.L.5 of this section.

3. Prohibition of bypass

a. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The permittee submitted notices as required under Part II.M.2 of this section.

b. The Department may approve an anticipated bypass, after considering its adverse effects, if the Department determines that it will meet the three conditions listed above in Part II.M.3.a of this section.

N. Upset

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of Part II.N.2 of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated; and

   c. The permittee submitted notice of the upset as required in Part II.L.5.b(2) of this section.

   d. The permittee complied with any remedial measures required under Part II.D of this section.

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

O. Misrepresentation of Information

1. Any person making application for a NPDES discharge permit or filing any record, report, or other document pursuant to a regulation of the Department, shall certify that all information contained in such document is true. All application facts certified to by the applicant shall be considered valid conditions of the permit issued pursuant to the application.

2. Any person who knowingly makes any false statement, representation, or certification in any application, record, report, or other documents filed with the Department pursuant to the State law, and the rules and regulations pursuant to that law, shall be deemed to have violated a permit condition and shall be subject to the penalties provided for pursuant to 48-1-320 or 48-1-330.

Part III. Limitations and Monitoring Requirements

A. Effluent Limitations and Monitoring Requirements

1. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **001**: once through cooling water[2]

Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	Mass		Concentration			
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow (effluent)	MR[1], MGD	MR[1], MGD	--	--	hourly	pump logs
Temperature (intake)	--	--	MR[1], °F	MR[1], °F	hourly	continuous
Temperature (effluent)[3]	--	--	MR[1], °F	100 °F	hourly	continuous
Temperature (effluent)[4]	--	--	MR[1], °F	103 °F	hourly	continuous
Temperature (difference)[5]	--	--	--	22 °F	hourly	calculation

[1] MR: Monitor and Report
[2] See Part I.U.
[3] This limit applies unless critical hydrological and meteorological conditions are combined with high customer demand, which cannot be met from other sources as determined by the System Operations Center.
[4] This limit applies only when critical hydrological and meteorological conditions are combined with high customer demand, which cannot be met from other sources as determined by the System Operations Center.
[5] This limit applies when the intake temperature is greater than 68°F. The temperature difference shall be determined by the effluent temperature minus the intake temperature.

a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at the point of discharge from Outfall 001 prior to commingling with the receiving waters, unless otherwise specified above. Temperature shall be monitored at both the intake and the discharge.

2. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **002**: low volume waste sources[2], treated chemical metal cleaning waste[3] *(see internal outfall 005)*, landfill leachate *(see internal outfall 006)*, intake dam underdrain, indigenous springs, and gravity drain system

   Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	Mass		Concentration			
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow, effluent	MR[1], MGD	MR[1], MGD	--	--	1/week	instantaneous
pH	Min 6.0 su, Max 8.5 su[4]				1/week	grab
Total Suspended Solids (TSS)	--	--	21.7 mg/l	43.8 mg/l	1/month	grab
Oil and Grease	--	--	3.07 mg/l	4.09 mg/l	1/month	grab
Total Residual Chlorine (TRC)[5]	--	--	0.011 mg/l	0.019 mg/l	1/month	grab

[1] MR: Monitor and Report
[2] See Part I.P.
[3] See Part I.F.
[4] See Part I.Q.
[5] See Part V.A.5.

a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): after treatment and prior to mixing with the receiving stream (Keowee River below the Keowee Hydrostation).

b. Sampling shall not occur during periods when the gravity drain system is being discharged via this Outfall.

Modification Effective Date: **December 1, 2010**

3. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **003**: treated sanitary wastewater *(final discharge through outfall 002)*

   The site's sanitary wastewater has been tied into the Oconee Joint Regional Sewer Authority's system. This outfall has been eliminated effective December 1, 2010.

4. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **004**: low level radiological wastes[6] and treated chemical metal cleaning waste[2] *(see internal outfall 005)*

Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	Mass		Concentration			
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow, effluent	MR[1], MGD	MR[1], MGD	--	--	1/month	estimate
pH, service water intake	Min MR[1] su, Max MR[1] su[3]				1/month	grab
pH, effluent	Max 8.5 su[3]				1/month	grab
pH, effluent[4]	Min 6.0 su[3]				1/month	grab
pH, difference[5]	--	--	--	≤ 0.1 su	1/month	calculate

[1] MR: Monitor and Report
[2] See Part I.F.
[3] See Part I.Q.
[4] This limit applies, unless the service water intake is 6.0 su or less, then the pH difference limitation becomes effective.
[5] When the pH of the service water intake is 6.0 su or less, the effluent pH shall not be more than 0.1 su below the service water intake. The pH difference shall be determined by the service water intake pH minus the effluent pH.
[6] This discharge is also regulated by the Nuclear Regulatory Commission (NRC) and is monitored per their specifications and the results are reported to NRC.

a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): after treatment, but prior to mixing with the receiving stream (Keowee River).

5. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **005**: treated chemical metal cleaning waste[2] *(final discharge through either outfall 002 or 004)*

Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	Mass		Concentration			
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow, effluent	MR[1], MGD	MR[1], MGD	--	--	1/batch	instantaneous
Total Suspended Solids (TSS)	--	--	30 mg/l	100 mg/l	1/batch	grab
Oil and Grease	--	--	15 mg/l	20 mg/l	1/batch	grab
Iron, total recoverable	--	--	1.0 mg/l	1.0 mg/l	1/batch	grab
Copper, total recoverable	--	--	1.0 mg/l	1.0 mg/l	1/batch	grab

[1] MR: Monitor and Report
[2] See Part I.F.

a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): after treatment near the discharge point, but prior to mixing with other wastestreams.

6. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **006**: landfill leachate *(final discharge through outfall 002)*

Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	Mass		Concentration			
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow, effluent	MR[1], MGD	MR[1], MGD	--	--	1/quarter	instantaneous
Biochemical Oxygen Demand (BOD_5)[2]	--	--	--	MR[1], mg/l	1/quarter	grab
Nitrite and Nitrate, total as N[2]	--	--	--	MR[1], mg/l	1/quarter	grab
Total Organic Carbon (TOC)	--	--	--	MR[1], mg/l	1/quarter	grab
Selenium, total recoverable	--	--	--	MR[1], mg/l	1/quarter	grab
Zinc, total recoverable	--	--	--	MR[1], mg/l	1/quarter	grab
Copper, total recoverable	--	--	--	MR[1], mg/l	1/quarter	grab

[1] MR: Monitor and Report

[2] These parameters will not be monitored, unless sewage sludge is disposed in the landfill. If sewage sludge is placed in the landfill, monitoring will begin starting on the quarter after the first disposal of sewage sludge and continue for the duration of the permit.

a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): after treatment near the discharge point, but prior to mixing with other wastestreams.

7. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee is authorized to discharge from outfall serial number **007**: Hydroelectric wastewaters[1]

Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS[2]	
	Mass		Concentration			
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Oil and Grease	--	--	--	0[3]	1/month	observation

[1] See Part I.P.

[2] No sampling shall apply; however, visual inspections shall take place at least once per month to detect oil leaks. All inspections shall be documented. Permittee shall document compliance with this requirement by preparing a detailed report that must be kept at the facility. The report must include spill history, actions taken to eliminate the oil source, and spill prevention BMPs measures adopted by the facility in order to prevent the occurrence of leaks. If an oil sheen is observed on the receiving stream, the permittee shall contact the EQC Regional Office within 24-hours to report the incident.

[3] Monitoring shall be accomplished by visual observation of the receiving water surface in the vicinity of the discharge. Report "0" if no oil sheen or film is observed or "1" if an oil sheen or film is observed.

a. Visual observations conducted in compliance with the monitoring requirements specified above shall be taken at the following location(s): below the dam and upstream of outfall 002 in the Keowee River.

B. Whole Effluent Toxicity and Other Biological Limitations and Monitoring Requirements

1. During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge from outfall **002**: low volume waste sources[1], treated chemical metal cleaning waste[2] *(see internal outfall 005)*, landfill leachate *(see internal outfall 006)*, intake dam underdrain, indigenous springs, and gravity drain system

   Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Average	Dailiy Maximum	Measurement Frequency	Sample Type
Ceriodaphnia dubia Acute Whole Effluent Toxicity @ ATC= **100%**	--	0*	1/quarter	24-hr composite

[1] See Part I.P.
[2] See Part I.F.
* Report "0" if test passes or "1" if test fails in accordance with Part V.B.1

   a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): after treatment near the discharge point, but prior to mixing with the receiving waters or other waste streams.

2. During the period beginning on the effective date and lasting through the expiration date, the permittee is authorized to discharge from outfall **002**: low volume waste sources[1], treated chemical metal cleaning waste[2] *(see internal outfall 005)*, landfill leachate *(see internal outfall 006)*, intake dam underdrain, indigenous springs, and gravity drain system

   Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Ceriodaphnia dubia Chronic Whole Effluent Toxicity @ CTC= **19.4%**	25 %	40 %	1/quarter	24-hr composite

[1] See Part I.P.
[2] See Part I.F.

See Part V.B.2 for additional toxicity reporting requirements.

The following notes apply only to valid tests. For invalid tests see Part V.B.2

Note 1: The overall % effect is defined as the larger of the % survival effect or the % reproduction effect from DMR Attachment Form 3880.

Note 2: If only one test is conducted during a month, the monthly average and daily maximum are each equal to the overall % effect.

Note 3: If more than one test is conducted during a month, the monthly average is the arithmetic mean of the overall % effect values of all tests conducted during the month.

Note 4: The monthly average to be reported on the DMR is the highest monthly average for any month during the monitoring period. There is no averaging of data from tests from one month to another.

Note 5: The daily maximum to be reported on the DMR is the highest of the % survival effect or % reproduction effect of all tests conducted during the monitoring period.

Note 6: When a sample is collected in one month and the test is completed in the next month, the overall % effect applies to the month in which the sample was collected.

Note 7: Tests must be separated by at least 7 days (from the time the first sample is collected to start one test until the time the first sample is collected to start a different test). There is no restriction on when a new test may begin following a failed or invalid test.

Note 8: For any split sample:

a. Determine the % survival effect and % reproduction effect values separately for each test.
b. Determine the arithmetic mean of the % survival effects and of the % reproduction effects for all tests.
c. The monthly average and daily maximum shall be the higher of the % effect values from (b) above.
d. For the purposes of reporting, split samples are reported as an individual sample regardless of the number of times it is split. All laboratories used shall be identified on the DMR attachment and each test shall be reported individually on DMR Attachment Form DHEC 3880 (08/2005).

a. Samples used to demonstrate compliance with the discharge limitations and monitoring requirements specified above shall be taken at or near the final point-of-discharge but prior to mixing with the receiving waters or other waste streams.

C. Groundwater Monitoring Requirements

1. Please reference **BoW Site ID #00535** on all reports. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee shall monitor each of the eight (8) groundwater monitoring wells A-1, A-2, A-8, A-10, A-11, A-12, A-13 and BG-4 as specified below:

PARAMETER	MEASUREMENT FREQUENCY[1]	SAMPLE METHOD	REQUIREMENT
Water Table Elevation	semi-annual	Field Measurement	MR[2]
Depth to Water Table	semi-annual	Field Measurement	MR[2]
Field pH	semi-annual	Field Measurement	MR[2]
Field Specific Conductance	semi-annual	Field Measurement	MR[2]
Ammonia-Nitrogen	semi-annual	Pump or Bailer Method	MR[2]
Nitrate	semi-annual	Pump or Bailer Method	MR[2]
Sulfate	semi-annual	Pump or Bailer Method	MR[2]
Barium, total	semi-annual	Pump or Bailer Method	MR[2]
Copper, total	semi-annual	Pump or Bailer Method	MR[2]

[1] Semi-annual samples shall be taken in the second and fourth calendar quarter of each year.
[2] MR: Monitor and Report

2. Please reference **BoW Site ID #00535** on all reports. During the period beginning on the effective date of this permit and lasting through the expiration date, the permittee shall monitor the four (4) groundwater monitoring wells A-1, A-10, A-11 and A-13 as specified below:

PARAMETER[4]	MEASUREMENT FREQUENCY[1]	SAMPLE METHOD	REQUIREMENT
Fission and Activation Products[3]	semi-annual	Pump or Bailer Method	MR[2], pCi/L
Tritium	semi-annual	Pump or Bailer Method	MR[2], pCi/L

[1] Semi-annual samples shall be taken in the second and fourth calendar quarter of each year.
[2] MR: Monitor and Report
[3] Note that all fission and activation products that are detected in the radiological sampling are to be reported.
[4] See Part V.C.4

Part IV. Schedule of Compliance

A. Schedule(s)

Not Applicable

B. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each scheduled date.

Part V. Other Requirements

A. Effluent Requirements

1. There shall be no discharge of floating solids or visible foam in other than trace amounts, nor shall the effluent cause a visible sheen on the receiving waters.

2. There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid.

3. Chlorine may not be added to the condenser cooling water unless the permit is modified to include chlorine limitations (TRC, FAC, etc).

4. Unless authorized elsewhere in this Permit, the permittee must meet the following requirements concerning maintenance chemicals for the following waste streams: once-through noncontact cooling water, recirculated cooling water, boiler blowdown water, and air washer water. Maintenance chemicals shall be defined as any man-induced additives to the above-referenced waste streams.

   a. Detectable amounts of any of the one hundred and twenty-six priority pollutants is prohibited in the discharge, if the pollutants are present due to the use of maintenance chemicals.

   b. Slimicides, algicides and biocides are to be used in accordance with registration requirements of the Federal Insecticides, Fungicide and Rodenticide Act.

   c. The use of maintenance chemicals containing bis(tributyltin) oxide is prohibited.

   d. Any maintenance chemicals added to the above-referenced waste streams must degrade rapidly, either due to hydrolytic decomposition or biodegradation.

   e. Discharges of maintenance chemicals added to waste streams must be limited to concentrations which protect indigenous aquatic populations in the receiving stream.

   f. The permittee must keep sufficient documentation on-site that would show that the above requirements are being met. The information shall be made available for on-site review by Department personnel during normal working hours.

   g. The occurrence of instream problems may necessitate the submittal of chemical additive data and permit modification to include additional monitoring and limitations.

5. Where the permit limitation Part III is below the practical quantitation limit (PQL), the PQL and analytical method stated below shall be considered as being in compliance with the permit limit. Additionally, where the permit requires only monitoring and reporting (MR) in Part III, the PQL and analytical method stated below shall be used for reporting results.

Parameter	Analytical Method	PQL
Biochemical Oxygen Demand (BOD)	SM5210B	2.0 mg/l
Total Organic Carbon (TOC)	SM5310 B, SM5310 C, SM5310 D	1.0 mg/l
Total Residual Chlorine (TRC)	SM4500Cl B, C, D, E, F or G	0.050 mg/l
Copper, total	200.7, 200.8, 200.9, SM3113B	0.010 mg/l
Nitrate-Nitrite	SM 4500 NO_3 E, H	0.020 mg/l
Selenium	200.8, 200.9, SM3113B	0.005 mg/l
Zinc, total	200.7, 200.8, SM3111B	0.010 mg/l

B. Whole Effluent Toxicity and Other Biological Requirements

1. For the requirements identified in Part III.B.1:

   a. A 48-hour static acute toxicity test shall be conducted at the frequency stated in Part III.B Effluent Toxicity Limitations and Monitoring Requirements using a control and the acute test concentration (ATC) of **100 %**. The test shall be conducted using *Ceriodaphnia dubia* as the test organism using EPA Method 2002.0 in accordance with "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms," EPA 821/R-02/012 (October 2002). The test shall be conducted at 25°C ±1°C.

   b. If the test group *Ceriodaphnia dubia* survival is less than the control group survival at the 0.05α level of a left-tailed Fisher's exact test, the test shall be deemed a failure.

   c. The permittee must report on the discharge monitoring report (DMR) form whether the test passes or fails at the specified ATC. If the test fails, the number "1" shall be placed on the form. If the test passes, the number "0" shall be placed on the form. If more than one test is performed during a monitoring period (including tests from split samples with other labs, not including the DHEC laboratory), the worst-case result shall be reported on the DMR. The DMR Attachment for Toxicity Test Results, DHEC Form 3420, shall also be completed and submitted with the DMR.

   d. A test shall be invalidated if any part of Method 2002.0 is not followed or if the laboratory is not certified at the time the test is conducted.

   e. All valid toxicity test results shall be submitted on the DHEC Form 3710 entitled "DMR Attachment for Toxicity Test Results" in accordance with Part II.L.4. In addition, results from all invalid tests must be appended to DMRs, including lab control data. The permittee has sole responsibility for scheduling toxicity tests so as to ensure there is sufficient opportunity to complete and report the required number of valid test results for each monitoring period.

   f. The permittee is responsible for reporting a valid test during each monitoring period. However, the Department acknowledges that invalid tests may occur. All of the following conditions must be satisfied for the permittee to be in compliance with Whole Effluent Toxicity (WET) testing requirements for a particular monitoring period when a valid test was not obtained.

      (1) A minimum of five (5) tests have been conducted which were invalid in accordance with Part V.B.1.d above;

      (2) The data and results of all invalid tests are attached to the DMR;

      (3) At least one additional State-certified laboratory is used after two (2) consecutive invalid tests were determined by the first laboratory. The name(s) and lab certification number(s) of the additional lab(s) shall be reported in the comment section of the DMR; and

      (4) A valid test was reported during each of the previous three reporting periods.

      If these conditions are satisfied, the permittee may enter "H" in the appropriate boxes on the toxicity DMR and add the statement to the Comment Section of the DMR that "H indicates invalid tests."

g. This permit may be modified based on new information that supports a modification in accordance with Regulation 61-9.122.62 and Regulation 61-68.D.

2. For the requirements identified in Part III.B.2:

a. A *Ceriodaphnia dubia* three brood chronic toxicity test shall be conducted at the frequency stated in Part III.B, Effluent Toxicity Limitations and Monitoring Requirements, using the chronic test concentration (CTC) of **19.4%** and the following test concentrations: **0% (control), 4.0%, 8.9%, 44.7% and 100%** effluent. The permittee may add additional test concentrations without prior authorization from the Department provided that the test begins with at least 10 replicates in each concentration and all data is used to determine permit compliance.

b. The test shall be conducted using EPA Method 1002.0 in accordance with "Short-Term Methods for Estimating Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms," EPA/821/R-02/013 (October 2002).

c. The permittee shall use the linear interpolation method described in "Short-Term Methods for Estimating Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms," EPA/821/R-02/013 (October 2002), Appendix M to estimate the percent effect at the CTC according to the equations in d below.

d. The linear interpolation estimate of percent effect is $\left(1-\frac{M_{CTC}}{M_1}\right)*100$ if the CTC is a tested concentration.

Otherwise, it is $\left(1-\frac{M_J-\frac{M_{J+1}-M_J}{C_{J+1}-C_J}*C_J+\frac{M_{J+1}-M_J}{C_{J+1}-C_J}*CTC}{M_1}\right)*100.$

e. A test shall be invalidated if any part of Method 1002.0 is not followed or if the laboratory is not certified at the time the test is conducted.

f. All valid toxicity test results shall be submitted on the DHEC Form 3880 (08/2005) entitled "DMR Attachment for Toxicity Test Results" in accordance with Part II.L.4. In addition, results from all invalid tests must be appended to DMRs, including lab control data. The permittee has sole responsibility for scheduling toxicity tests so as to ensure there is sufficient opportunity to complete and report the required number of valid test results for each monitoring period.

g. The permittee is responsible for reporting a valid test during each monitoring period. However, the Department acknowledges that invalid tests may occur. All of the following conditions must be satisfied for the permittee to be in compliance with Whole Effluent Toxicity (WET) testing requirements for a particular monitoring period when a valid test was not obtained.

(1) A minimum of three (3) tests have been conducted which were invalid in accordance with Part V.B.1.e above;

(2) The data and results of all invalid tests are attached to the DMR;

(3) At least one additional State-certified laboratory was used after two (2) consecutive invalid tests were determined by the first laboratory. The name(s) and lab certification number(s) of the additional lab(s) shall be reported in the comment section of the DMR; and

(4) A valid test was reported during each of the previous three reporting periods.

If these conditions are satisfied, the permittee may enter "H" in the appropriate boxes on the toxicity DMR and add the statement to the Comment Section of the DMR that "H indicates invalid tests."

h. This permit may be modified based on new information that supports a modification in accordance with Regulation 61-9.122.62 and Regulation 61-68.D.

C. Groundwater Requirements

1. All of the groundwater monitoring wells must be properly maintained at all times so that they yield representative aquifer samples.

2. Groundwater sample collection methods shall be in accordance with the EPA Environmental Investigations Standard Operating Procedures and Quality Assurance Manual dated November 2001 or the most recent revision.

3. The permittee shall notify SC DHEC within thirty (30) calendar days after receipt of the results for groundwater monitoring and becoming aware of an exceedance of a primary drinking water standard for any parameter specified in this permit that has an assigned MCL.

4. Groundwater monitoring wells A-1, A-10, A-11 and A-13 shall be sampled for the following parameters in accordance with the SCDHEC approved Groundwater Sampling and Analysis Plan and the results reported in the renewal permit application:

Carbonhydrazide
Naphthalene (SM 8260 B)
Volatiles (SM 8260 B)
Tritium (EPA Method 906.0 or SM 7500-3H B)
Gamma Emitters (EPA Method 901.1 or SM 7120)

D. Sludge Requirements

1. Disposal of all residues, waste oils, and hazardous wastes shall meet requirements of SC-DHEC's Bureau of Land and Waste Management (BLWM).

2. Solid wastes and sanitary treatment sludge shall be disposed at the Oconee Nuclear Station Landfill in accordance with BLWM Industrial Solid Waste Permit No. 373303-1601. The permittee shall obtain written approval from the Bureau of Water's Industrial Wastewater Permitting Section prior to sending the sanitary treatment sludge off-site for disposal.

3. Written approval from the Department must be obtained prior to disposal of other sludges or use of other sludge disposal methods.

E. Other Conditions

1. The process wastewater treatment system is assigned a classification of **Group I-Physical/Chemical**. This classification will require the performance of routine daily treatment plant inspections by a certified operator with a **Grade D-Physical/Chemical** or higher certificate. For a period of one year after the effective date of this permit the routine daily treatment plant inspections may be performed by an operator with a **Grade D** or higher **physical/chemical or biological** certification.

2. The permittee shall maintain an all weather access road to the wastewater treatment plant and appurtenances at all times.

3. The permittee shall continue to maintain a Best Management Practices (BMP) plan to identify and control the discharge of significant amounts of oils and the hazardous and toxic substances listed in 40 CFR Part 117 and Tables II and III of Appendix D to 40 CFR Part 122. The plan shall include a listing of all potential sources of spills or leaks of these materials, a method for containment, a description of training, inspection and security procedures, and emergency response measures to be taken in the event of a discharge to surface waters or plans and/or procedures which constitute an equivalent BMP. Sources of such discharges may include materials storage areas; in-plant transfer, process and material handling areas; loading and unloading operations; plant site runoff; and sludge and waste disposal areas. The BMP plan shall be developed in accordance with good engineering practices, shall be documented in narrative form, and shall include any necessary plot plans, drawings, or maps. The BMP plan shall be maintained at the plant site and shall be available for inspection by EPA and Department personnel.

4. The company shall notify the South Carolina Department of Health and Environmental Control in writing no later than sixty (60) days prior to instituting use of any additional maintenance chemicals in the condenser cooling water system. Such notification shall include:

   a. Name and general composition of the maintenance chemical
   b. Quantities to be used
   c. Frequency of use
   d. Proposed discharge concentration
   e. EPA registration number, if applicable
   f. Aquatic toxicity information

5. The permittee shall monitor all parameters consistent with conditions established by this permit on the **1st Tuesday** of every calendar month in which sampling is required, unless otherwise approved by this Department. If this day falls on a holiday, sampling shall be conducted on the next business day. If no discharge occurs on this day, the permittee shall collect an effluent sample during the reporting period on a day when there is a discharge. Additional monitoring as necessary to meet the frequency requirements of this permit shall be performed by the permittee.

6. The permittee shall notify the affected downstream water treatment plant(s) of any emergency condition, plant upset, bypass or other system failure which has the potential to affect the quality of water withdrawn for drinking water purposes. This notification should be made as soon as possible and in anticipation of such event, if feasible, without taking away from any response time necessary to attempt to alleviate the situation.

7. All stormwater discharges, which do not discharge through the outfalls listed by this permit, shall be covered under the Department's NPDES General Permit for Storm Water Discharges Associated With Industrial Activity. The facility was granted coverage on September 30, 1993, and the permit certification number is SCR000074.

8. Intake screen wash water, pump strainer backwash water, fire protection water, and potable water systems may be discharged without limitations or monitoring requirements. Appropriate measures shall be taken to minimize any impact to the environmental. The NPDES General Permit for Storm Water Discharges Associated With Industrial Activity may cover some of the fire protection water.

9. In January 1995, the permittee provided information to support the request that alternative thermal limits be imposed under Section 316(a) of the Clean Water Act. A determination was made in February 1995 that the permittee had submitted adequate information to demonstrate that such alternative limitations on the thermal component of this discharge will assure the protection and propagation of a balanced, indigenous population of fish, shellfish, and wildlife in and on Lake Keowee/Keowee River. The Department received an updated 316(a) Demonstration Report dated June 2007 and a 316(a) study plan dated March 2009. A determination has been made that continuation of this 316(a) variance is appropriate in the reissuance of this permit.

10. The permittee shall submit an updated 316(a) demonstration with each permit renewal to continue with a thermal variance at Outfall 001 in future permits in accordance with Regulation 61-9.122.21(m)(6).

11. This permit may be reopened to address compliance with 316(b) requirements for cooling water intake structures upon resolution of the EPA regulations in 40 CFR Part 125 Subpart J.