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RA-22-0285
November 7, 2022

10 CFR 50.4
10 CFR 51.41
10 CFR Part 54

ATTN: NRC Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Oconee Nuclear Station (ONS), Units 1, 2, and 3
Docket Numbers 50-269, 50-270, 50-287
Renewed License Numbers DPR-38, DPR-47, DPR-55
Subsequent License Renewal - Appendix E Environmental Report Supplement 2

References:

1. Duke Energy Letter (RA-21-0132) dated June 7, 2021, Application for Subsequent Renewed Operating Licenses, (ADAMS Accession Number ML21158A193)
2. NRC Letter dated July 22, 2021, Oconee Nuclear Station, Units 1, 2, and 3 - Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding Duke Energy Carolinas' Application for Subsequent License Renewal (ADAMS Accession Number ML21194A245)
3. NRC Letter dated September 21, 2021, Oconee Nuclear Station, Units 1, 2, and 3 License Renewal Regulatory Audit Regarding the Environmental Review of the Subsequent License Renewal Application Review, (ADAMS Accession Number ML21263A031)
4. NUREG-1437 Revision 1 dated June 2013, Final Generic Environmental Impact Statement for License Renewal of Nuclear Plants (ADAMS Accession Nos. ML13106A241, ML13106A242, ML13106A244)
5. Duke Energy Letter (RA-21-0297) dated November 11, 2021, Subsequent License Renewal Application, Appendix E Environmental Report Supplement 1, (ADAMS Accession Number ML21328A163)
6. CLI-22-02 Commission Memorandum and Order dated February 24, 2022 (ADAMS Accession Number ML22055A496)
7. CLI-22-03 Commission Memorandum and Order dated February 24, 2022 (ADAMS Accession Number ML22055A527)

By letter dated June 7, 2021 (Reference 1), Duke Energy Carolinas, LLC (Duke Energy) submitted an application for the subsequent license renewal of Renewed Facility Operating License Numbers DPR-38, DPR-47, and DPR-55 for the Oconee Nuclear Station (ONS), Units 1, 2, and 3 to the U.S. Nuclear Regulatory Commission (NRC). On July 22, 2021 (Reference 2), the NRC determined that ONS subsequent license renewal application (SLRA) was acceptable and sufficient for docketing. By letter dated September 21, 2021 (Reference 3), the NRC issued the regulatory audit plan for the environmental portion of the SLRA review. During the audit conducted the week of October 11, 2021, Duke Energy agreed to supplement the Environmental Report with new or clarifying information. This supplemental information for the SLRA Environmental Report was provided by Reference 5.

Earlier this year in Commission Orders CLI-22-02 and CLI-22-03 (References 6 and 7, respectively), the Commission determined that the 2013 Generic Environmental Impact Statement (GEIS) analyses (Reference 4) and codified conclusions were applicable to initial license renewals, and that additional analyses are needed to support environmental reviews in subsequent license renewal proceedings. The Commission directed the NRC Staff to prepare an updated GEIS applicable to subsequent license renewal but provided applicants the option of supplementing their Environmental Reports and proceeding in a site-specific manner. Accordingly, Duke Energy elected to and completed a site-specific subsequent license renewal environmental review of ONS Units 1, 2 and 3 operations.

For issues that are applicable to ONS, the discussion in the attached Enclosure includes the corresponding generic analysis from the 2013 GEIS and supplements that analysis with further additional site-specific analysis for the Subsequent Period of Extended Operation (SPEO). The additional site-specific analysis evaluates the impact of any relevant new site-specific information on the environmental consequences of continued plant operation in the SPEO.

Duke finds that the site-specific analysis demonstrates that the collective environmental impacts associated for the proposed SPEO term are small and that those analyses satisfy the requirements of 10 CFR 51.53(c)(2) and 10 CFR 51.45.

In addition, Duke Energy has performed a review to identify any new, materially significant information relevant to the other environmental issues discussed in Chapter 4 of our previously submitted Environmental Report provided in Appendix E of the SLRA submitted June 7, 2021 (Reference 1). Duke Energy has determined that there is no new and significant information identified since the SLRA submitted June 7, 2021 (Reference 1).

Should you have any questions regarding this submittal, please contact Arun Kapur at (919) 793-4220 or by email at arun.kapur@duke-energy.com.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 7, 2022.

Sincerely,

Steven M. Snider
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Oconee Nuclear Station

Enclosure:

Subsequent License Renewal Application, Appendix E Environmental Report Supplement 2

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ENCLOSURE

OCONEE NUCLEAR STATION
SUBSEQUENT LICENSE RENEWAL APPLICATION, APPENDIX E
ENVIRONMENTAL REPORT SUPPLEMENT 2

Appendix E Environmental Report Supplement 2

Affected SLRA Section:

ER Section 4.0, Environmental Consequences of the Proposed Action and Mitigating Actions

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

Licensees are required by 10 CFR 51.53(c)(1) to submit with its application a separate document entitled "Applicant's Environmental Report—Operating License Renewal Stage." The Nuclear Regulatory Commission's (NRC) regulations at 10 CFR Part 51, which implement Section 102(2) of the National Environmental Policy Act of 1969, as amended (NEPA), include requirements for applicants to provide information as may be useful in aiding the NRC staff in complying with NEPA. As part of its review, the NRC staff is required to prepare a site-specific Supplemental Environmental Impact Statement (SEIS). Review guidance for the staff is provided in NUREG–1555, Supplement 1, Revision 1, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Supplement 1 – Operating License Renewal."

In the 2013 GEIS, the NRC identified and analyzed 78 environmental issues that it considers to be associated with nuclear power plant license renewal. The NRC also codified conclusions for those issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Twelve of those issues are not applicable to Oconee Nuclear Station (ONS) because they result from design or operational features that do not exist at the facility.

In CLI-22-2 and CLI-22-3, the Commission determined that those 2013 GEIS analyses and codified conclusions were applicable to initial license renewals, and that additional site-specific analyses for the subsequent period of extended operation (SPEO) (e.g., 60 to 80 years) are needed to support environmental reviews in SLR proceedings.

For issues that are applicable to ONS, the discussion below incorporates the corresponding generic analysis from the 2013 GEIS, and supplements that analysis with a further additional site-specific analysis for the SPEO. The additional site-specific analysis evaluates the impact of any relevant new site-specific information on the environmental consequences of continued plant operation during the SPEO.

With the exception of threatened and endangered species/essential fish habitat (EFH), historic and cultural resources, environmental justice, and electromagnetic fields (EMFs), 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 remaining issues as follows (NRC 2013a):

- For threatened and endangered species (Endangered Species Act [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 designated critical habitat. 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.
- For historic and cultural resources (National Historic Preservation Act) 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 not adversely affected (no adverse effect); or (3) historic properties are adversely affected (adverse effect).
- For environmental justice, impacts would be based on disproportionately high and adverse human health and environmental effects on minority and low-income populations.

- The issue of chronic effects of EMFs remains uncategorized because there is no national scientific consensus on the potential impacts from chronic exposure to EMFs. (NRC 2013a)

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).

4.0.1 FORMAT OF ISSUES REVIEWED

The review and analysis provided by this supplement generally follows NRC Regulatory Guide 4.2, Supplement 1, Revision 1, with certain modifications that are consistent with the Commission's ruling in CLI-22-2 and CLI-22-3, as summarized below.

- *Issue*: Title of the issue.
- *Generic Analysis for Initial License Renewals*: A background excerpt from the applicable section of the GEIS. The specific section of the GEIS is referenced for the convenience of the reader.
- *Site-Specific Analysis for ONS SPEO*: An analysis of the environmental impact, taking into account current site-specific information – inclusive of review of relevant new 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.

Table 4.0-2a below, provides a list of the applicable environmental issues that Duke Energy evaluated as part of this supplement.

Table 4.0-2a Environmental Resource Issues Evaluated for ONS SPEO

Issue	ONS SLRA ER Section	New or Existing ER Section
Onsite Land Uses	4.1.1	Existing
Offsite Land Uses	4.1.2	Existing
Aesthetic Impacts	4.1.3	Existing
Air Quality Impacts (All Plants)	4.2.1	Existing
Air Quality Effects of Transmission Lines	4.2.2	Existing
Noise Impacts	4.3	Existing
Geology and Soils	4.4	Existing
Surface Water Use and Quality (Non-Cooling System Impacts)	4.5.6	New

Issue	ONS SLRA ER Section	New or Existing ER Section
Altered Current Patterns at Intake and Discharge Structures	4.5.7	New
Altered Thermal Stratification of Lakes	4.5.8	New
Scouring Caused by Discharged Cooling Water	4.5.9	New
Discharge of Metals in Cooling System Effluent	4.5.10	New
Discharge of Biocides, Sanitary Wastes, and Minor Chemical Spills	4.5.11	New
Surface Water Use Conflicts (Plants with Once-Through Cooling Systems)	4.5.12	New
Effects of Dredging on Surface Water Quality	4.5.13	New
Temperature Effects on Sediment Transport Capacity	4.5.14	New
Groundwater Contamination and Use (Non-Cooling System Impacts)	4.5.15	New
Groundwater Use Conflicts (Plants that Withdraw Less than 100 Gallons per Minute)	4.5.16	New
Groundwater Quality Degradation Resulting from Water Withdrawals	4.5.17	New
Exposure of Terrestrial Organisms to Radionuclides	4.6.7	New
Cooling System Impacts on Terrestrial Resources (Plants with Once-Through Cooling Systems or Cooling Ponds)	4.6.8	New
Bird Collisions with Plant Structures and Transmission Lines	4.6.9	New
Transmission Right-of-Way Management Impacts on Terrestrial Resources	4.6.10	New
Electromagnetic Fields on Flora and Fauna (Plants, Agricultural Crops, Honeybees, Wildlife, Livestock)	4.6.11	New
Entrainment of Phytoplankton and Zooplankton (All Plants)	4.6.12	New
Infrequently Reported Thermal Impacts (All Plants)	4.6.13	New
Effects of Cooling Water Discharge on Dissolved Oxygen, Gas Supersaturation, and Eutrophication	4.6.14	New
Effects on Non-Radiological Contaminants on Aquatic Organisms	4.6.15	New
Exposure of Aquatic Organisms to Radionuclides	4.6.16	New
Effects of Dredging on Aquatic Organisms	4.6.17	New

Issue	ONS SLRA ER Section	New or Existing ER Section
Effects on Aquatic Resources (Non-Cooling System Impacts)	4.6.18	New
Impacts of Transmission Line Right-of-Way Management on Aquatic Resources	4.6.19	New
Losses from Predation, Parasitism, and Disease Among Organisms Exposed to Sub-Lethal Stresses	4.6.20	New
Employment and Income, Recreation, and Tourism	4.8.1	Existing
Tax Revenues	4.8.2	Existing
Community Services and Education	4.8.3	Existing
Population and Housing	4.8.4	Existing
Transportation	4.8.5	Existing
Radiation Exposures to the Public	4.9.3	New
Radiation Exposures to Plant Workers	4.9.4	New
Human Health Impact from Chemicals	4.9.5	New
Microbiological Hazards to Plant Workers	4.9.6	New
Physical Occupational Hazards	4.9.7	New
Design-Basis Accidents	4.15.1	Existing
Low-Level Waste Storage and Disposal	4.11.1	Existing
Onsite Storage of Spent Nuclear Fuel	4.11.2	Existing
Offsite Radiological Impacts of Spent Nuclear Fuel and High-Level Waste Disposal	4.11.3	Existing
Mixed-Waste Storage and Disposal	4.11.4	Existing
Nonradioactive Waste Storage and Disposal	4.11.5	Existing
Offsite Radiological Impacts - Individual Impacts from other than the Disposal of Spent Fuel and High-Level Waste	4.13.1	Existing
Offsite Radiological Impacts - Collective Impacts from other than the Disposal of Spent Fuel and High-Level Waste	4.13.2	Existing
Non-Radiological Impacts of the Uranium Fuel Cycle	4.13.3	Existing
Transportation	4.13.4	Existing
Termination of Plant Operations and Decommissioning	4.14	Existing

ONSITE LAND USES

Affected SLRA Sections:

ER Section 4.1.1, Onsite Land Uses

4.1.1.1 Generic Analysis for Initial License Renewal [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 (SNF) and low-level radioactive waste (LLW) 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.

For initial license renewals, the NRC codified its conclusion that impacts related to onsite land use are expected to be 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 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on onsite land use since initial license renewal. Onsite land use information is discussed in ONS SLR ER Section 3.2.1. No subsequent license renewal-related refurbishment activities have been identified, as presented in SLR ER Section 2.3. (Duke 2021a) In the response to NRC request for additional information letter dated January 7, 2022, a new reasonably foreseeable project was identified which included the installation of a bullet trap system within the footprint of the existing ONS firing range. The project is scheduled to be completed by November 2022. Duke Energy conducted a review of projects that may impact onsite land use and identified several ongoing and planned projects. Ongoing projects include the implementation of Oconee thermal margin recapture uprates of 15 MWe for the three units, the addition of a new relay house and a 2,200-foot cable tray within the 230-kV switchyard that is scheduled to be completed by August 2023, and upgrades to the Bad Creek pump storage hydro station which are also scheduled to be completed in 2023. Planned projects include the relocation of a potable water line totaling approximately 7,500 feet and stretching from the intersection of Hwy 183 & 130, past the site security check point, and along the site entrance road to the ONS garage that is scheduled to

begin the first quarter of 2023, the replacement of a 582-foot segment of existing Maintenance Training Facility (MTF) stormwater drain line, and the removal of approximately 0.8 acres of trees within transmission right of ways that travel between the 230-kV switchyard and Keowee hydro as part of right of way maintenance. None of the projects discussed in this section have or would require changes to existing onsite land use, and no subsequent license renewal-related construction activities have been identified. Additionally, continued operation during the proposed SPEO term is not expected to change, and no refurbishment activities are anticipated. Therefore, no changes in onsite land use during the proposed SPEO term are anticipated.

Duke Energy finds that impacts to onsite land use for the proposed SPEO term would be SMALL.

OFFSITE LAND USES

Affected SLRA Sections:

ER Section 4.1.2, Offsite Land Uses

4.1.2.1 Generic Analysis for Initial License Renewal [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 initial license renewals, the NRC codified its conclusion that impacts related to offsite land use are expected to be SMALL. Offsite land use would not be affected by continued operations and refurbishment associated with license renewal.

In the GEIS, NRC also considered continued operations with regard to state coastal zone programs. 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. Consistency with the state CZMP assures that impacts in a state coastal zone will be SMALL.

4.1.2.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on offsite land use since initial license renewal. Offsite land use information is discussed in ONS SLR ER Section 3.2.2. As presented in Section 2.5 of the ONS SLR ER, there are no plans to add workers to support plant operations during the SPEO term, nor are any significant changes to tax payments anticipated (see Section 4.8.2). As presented in ONS SLR ER Section 2.3, no subsequent license renewal-related refurbishment activities have been identified (Duke 2021a). Duke Energy conducted a review of foreseeable projects that could impact current offsite land use and identified a new microwave/telecommunications tower project tentatively planned for construction and completion in 2023. The proposed 314-foot-high tower would be located southeast of the existing meteorological tower, west of the ONS site in area occupied by an existing softball field. The project

would include clearing an area of approximately 17,000 square feet, of which a large portion has already been cleared with only a small area of trees left to be removed. Given the relatively small project footprint, its location in an area that has been disturbed or developed prior to construction, and that the install is projected to be completed prior to the SPEO term, no changes in offsite land use during the proposed SPEO term are anticipated.

As presented in ONS SLR ER Section 9.5.10, ONS is not located in or near a coastal zone under the national CZMP and does not have the potential to impact a coastal zone or coastal watershed (Duke 2021a).

Duke Energy finds that impacts to offsite land use for the proposed SPEO term would be SMALL.

AESTHETIC IMPACTS

Affected SLRA Sections:

ER Section 4.1.3 Aesthetic Impacts

4.1.3.1 Generic Analysis for Initial License Renewal [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.

For initial license renewals, the NRC codified its conclusion that impacts related to aesthetics are expected to be 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 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on aesthetic impacts since initial license renewal. The visual appearance of the plant and in-scope transmission lines is discussed in the ONS SLR ER Section 3.2.3. As presented in the ONS SLR ER 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. (Duke 2021a)

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 the ONS SLR ER Section 2.3, no refurbishment or construction activities have been identified that would change the aesthetics of the ONS facility during the proposed SPEO term (Duke 2021a). Therefore, no changes in visual resources during the proposed SPEO term are anticipated.

Duke Energy conducted a review of on-site construction activities that could result in a noticeable change in the appearance characteristics of the site when viewed from offsite. Based on available data, the review included evaluating completed and planned projects since 2019 and any reasonably foreseeable projects. The review considered construction activities that would be large enough to be observed in the vicinity of ONS and in Lake Keowee. No construction activity was identified that would noticeably alter the aesthetic impacts of the site on the vicinity and from Lake Keowee. The review also considered vegetation that screens the site. There have been no noticeable changes in the vegetation that screens the site.

Duke Energy finds that impacts to aesthetics for the proposed SPEO term would be SMALL.

AIR QUALITY IMPACTS (ALL PLANTS)

Affected SLRA Sections:

ER Section 4.2.1, Air Quality Impacts (All Plants)

4.2.1.1 Generic Analysis for Initial License Renewal [GEIS Section 4.3.1.1]

As presented in the GEIS, 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 particulate matter 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, 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.

For initial license renewals, the NRC codified its conclusion that impacts related to air quality are expected to be SMALL. Air quality impacts from continued operations and refurbishment associated with license renewal are expected to be small at all plants.

4.2.1.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on air quality impacts since initial license renewal. Air quality information is presented in the ONS SLR ER Section 3.3.3. ONS utilizes a once-through cooling system for condenser cooling purposes, there are no cooling towers or associated particulate emissions. No refurbishment activities have been identified, as presented in the ONS SLR ER Section 2.3 (Duke 2021a). Best management practices (BMPs), including fugitive dust controls, the requirements of permit conditions in South Carolina Department of Health and Environmental Control (SCDHEC) air emissions permits, and compliance with air emission laws 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 (EPA 2022). As presented in ONS SLR ER 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 SPEO term were identified as necessary for plant operations. Since the ONS SLR ER Chapter 3 was written, two self-identified noncompliance events were reported to SCDHEC. Preventative maintenance of two generators was not performed within the required time recommended by the manufacturer. To resolve the issue, preventative maintenance was performed, and the events were entered into the corrective action program to prevent reoccurrence.

As discussed in the ONS SLR ER Section 3.3.3.2, ONS is permitted under air permit No. CM-1820-0041 (Duke 2021a). ONS compliance with current and future air quality regulatory requirements will minimize the potential for impacts to air quality. During the proposed SPEO term, appropriate air emission laws would regulate and mitigate any potential ONS activities that could increase air pollutants. Furthermore, no temporary impacts associated with refurbishment activities are expected. Therefore, Duke Energy finds that due to compliance with current air emissions regulatory requirements, applicable emissions control measures, and reporting requirements, air quality impacts for the proposed SLR term are SMALL.

Duke Energy finds that impacts to air quality for the proposed SPEO term would be SMALL.

AIR QUALITY EFFECTS OF TRANSMISSION LINES

Affected SLRA Section:

ER Section 4.2.2, Air Quality Effects of Transmission Lines

4.2.2.1 Generic Analysis for Initial License Renewal [GEIS Section 4.3.1.1]

The GEIS's consideration of air quality included a review of the effects of transmission lines. 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 is insignificant and does not measurably contribute to ambient levels of those gases.

For initial license renewals, the NRC codified its conclusion that impacts related to air quality effects of transmission lines are expected to be 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 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on air quality effects of in scope transmission lines since initial license renewal. Several studies determined that the amount of ozone generated by even the largest transmission lines in operation (765 kV) would be insignificant (NRC 2013a, Section 4.3.1.1). As discussed in the ONS SLR ER Section 2.2.5, the in-scope transmission lines at ONS are 230 kV and 525 kV (Duke 2021a). Therefore, the production of ozone and oxides of nitrogen would be de minimis.

Duke Energy finds that impacts to air quality effects of in scope transmission lines for the proposed SPEO term would be SMALL.

NOISE IMPACTS

Affected SLRA Sections:

ER Section 4.3, Noise Impacts

4.3.1 Generic Analysis for Initial License Renewal [GEIS Section 4.3.1.2]

The NRC considered the potential impacts of noise in its GEIS for license renewal. 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 A-weighted decibels (dBA) level that the EPA uses as a threshold level to protect against excess noise during outdoor activities. According to the EPA, however, 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.

For initial license renewals, the NRC codified its conclusion that impacts related to noise are expected to be SMALL. Noise associated with continued operation and refurbishment would not increase significantly during the period of extended operation.

4.3.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on noise impacts since initial license renewal. Noise associated with plant operations is presented in ONS SLR ER Section 3.4. ONS monitors noise at and around the plant site for occupational and ambient effects on an as-needed basis. As presented in ONS SLR ER Section 3.4, the Oconee County noise ordinance identifies specific sound levels of 70 dBA as a daytime (between 7:00 AM and

9:59 PM) level and 60 dBA as a nighttime (between 10:00 PM and 6:59 AM) level, measured 100 feet from the point which the sound is emanating. It further indicates that industrial facilities, including sirens and loudspeakers, are exempt from these requirements. (Duke 2021a)

Continued operation during the proposed SPEO is not expected to change. Additionally, as presented in ONS SLR ER Section 2.3, no subsequent license renewal-related refurbishment activities have been identified, although minor construction may occur onsite due to operational maintenance activities. As discussed in ONS SLR ER 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. (Duke 2021a) This is further demonstrated as ONS has not received any noise complaints from 2016 to 2021, and to date, no noise complaints have been received in 2022.

People living in the vicinity of ONS would not experience any changes in noise levels during the proposed SPEO term beyond what is currently being experienced. Given that ONS has not received any noise complaints from the public; that land use surrounding ONS is not projected to change; that no refurbishment activities are anticipated; and that there are no anticipated changes in noise levels associated with continued operations, Duke Energy finds that noise impacts for the proposed SPEO term would be SMALL.

GEOLOGY AND SOILS

Affected SLRA Sections:

ER Section 4.4, Geology and Soils

4.4.1 Generic Analysis for Initial License Renewal [GEIS Section 4.4.1]

The NRC considered the potential impacts from continued operations and refurbishment associated with license renewal on geologic and soil resources. The NRC considered 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.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL if BMPs are employed to control soil erosion and impacts on surface water quality. Ground disturbance associated with continued operations and refurbishment associated with license renewal would not change appreciably during the license renewal term.

4.4.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on geology and soil since initial license renewal. Geology and soils information is presented in Section 3.5 of the ONS SLR ER (Duke 2021a). Routine infrastructure, renovation, and maintenance projects would be expected during continued operation. As discussed in the ONS SLR Section 3.5.3.2 and Section 3.6.1.2.2, ONS maintains and implements a stormwater pollution prevention plan (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 (Duke 2021a). These practices, as they relate to erosion, include nonstructural preventive measures and source controls, and structural controls to prevent erosion or treat storm water containing pollutants caused by erosion. As described in the ONS SLR Section 3.6.1.2.2, nonstructural controls include personnel training, facility policy and procedures, environmental awareness, good housekeeping practices, security, preventative maintenance, and spill and emergency response (Duke 2021a). Structural measures include buildings, shelters, enclosures, dedicated secondary containments, paved loading/unloading locations, sumps, and oil/water separators. 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 subsequent license renewal-related refurbishment or construction activities are planned, any such activities would continue to be managed in adherence to the ONS SWPPP. In addition, ONS has a spill prevention, control, and countermeasure (SPCC) plan and a chemical control program (Duke 2021a, Section 9.5.3.5).

Duke Energy conducts ongoing plant operational and maintenance activities, including powerhouse expansion, dam repairs, boom line installation, and pipe repairs. Duke Energy will ensure that impacts to geology and soil from continued operations are SMALL during the SPEO term by complying with National Pollutant Discharge Elimination System (NPDES) regulatory requirements and permit conditions, implementation of a SWPPP, implementation of BMPs, and adhering to internal procedures. Duke Energy finds that geology and soil impacts for the proposed SPEO term would be SMALL.

SURFACE WATER USE AND QUALITY (NON-COOLING SYSTEM IMPACTS)

Affected SLRA Sections:

New ER Section 4.5.6, Surface Water Use and Quality (Non-Cooling System Impacts)

4.5.6.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1]

Surface Water Use

In the GEIS, NRC considered surface water use during refurbishment activities for concrete production, dust control, washing stations, facility and equipment cleaning, and soil compaction and excavation backfilling. Surface water consumption for non-cooling water-related operational activities is limited to such uses as facility and equipment cleaning. The use of public domestic water would reduce the direct consumptive use impacts on surface water resources. The impacts due to the volume of water consumed from a surface water source would be insignificant when compared with that used and consumed by a plant's cooling system. No surface use conflicts would be expected.

Surface Water Quality

The NRC considered the potential impacts of land disturbing activities, industrial wastewater, stormwater, residual chlorine due to domestic water runoff, and inadvertent spills resulting from nuclear plants' operations on surface water quality in its GEIS for license renewal. The NRC considered the mitigation measures of National Pollutant Discharge Elimination System (NPDES) permits, SWPPPs, BMPs, and pollution control structures, such as detention and infiltration basins. The NRC concluded that nuclear power plants' operation under NPDES permits and the implementation of BMPs would mitigate surface water quality impacts from non-cooling systems to be SMALL.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL if BMPs are employed to control soil erosion and spills. Surface water use associated with continued operations and refurbishment associated with license renewal would not increase significantly or would be reduced if refurbishment occurs during a plant outage.

4.5.6.2 Site-Specific Analysis for ONS SPEO

Surface Water Use

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on surface water use (non-cooling system impacts) since initial license renewal. Surface water is not used as potable or sanitary water at ONS. The potable and sanitary water is supplied by the Seneca water treatment plant. Using public domestic water reduces non-cooling water consumption. Non-cooling surface water withdrawals are limited to plant use, including facility and equipment cleaning (SCDHEC 2013; Duke 2021 Figure 2.2-3). ONS measures monthly surface water withdrawals but does not distinguish between withdrawals used for cooling versus non-cooling purposes; however, considering the public domestic water supply, the volume of water used for non-cooling purposes is negligible compared to the volume used for cooling purposes.

ONS's monthly surface water withdrawals for 2014 to 2018 are presented in the ONS SLR ER Table 3.6-4b (Duke 2021a). Based on monthly water withdrawal data for 2019 through 2021, the greatest monthly withdrawal for the condenser circulating water (CCW) system was 96,966 million gallons in August 2021, while the B5B emergency intake structure monthly withdrawal ranged from 0 to 350,000 gallons. A comparison between the CCW system and the B5B emergency intake structure withdrawals shows that the B5B emergency intake structure withdrawals are a negligible fraction of surface water withdrawals. As discussed in the ONS SLR ER Section 2.2.3.5, approximately 99 percent of the cooling water withdrawals are returned. Duke Energy finds that the impacts of non-cooling system surface water consumption for the proposed SPEO term would be SMALL.

Surface Water Quality

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on surface water quality (non-cooling system) impacts since initial license renewal. As discussed in the ONS SLR ER Section 3.6.1.2.1, wastewater is monitored and discharged to Lake Keowee and the Keowee River in accordance with the ONS NPDES Permit No. SC0000515. Duke Energy submitted a permit renewal application in 2013; the renewed permit has not been issued by SCDHEC. ONS NPDES Permit No. SC0000515 describes non-cooling water system discharges, sources, and constituent analysis, and it presents a mixing zone analysis for the non-cooling system discharges, supporting that the discharges can mix adequately to comply with permit limits. Stormwater discharges are also addressed in the NPDES permit, as discussed in the ONS SLR ER, Section 3.6.1.2.2. (Duke 2021a)

ONS operates in compliance with the NPDES general industrial stormwater permit and is assigned facility coverage SCR000074, per ONS SLR ER Section 9.5.3.3 (Duke 2021a). As presented

above in Section 4.4.2, Duke Energy complies with stormwater regulations, obtains necessary stormwater permits, and develops SWPPPs and implements BMPs. BMPs include nonstructural, or administrative, and structural, or physical approaches. Through these practices and structural devices designed to remove pollutants, reduce runoff rates and volumes, and protect aquatic habitats, the adverse stormwater-related effects of land disturbance and development and continued operations can be controlled.

As discussed in ONS SLR ER Section 9.5.3.5., ONS also has an SPCC plan that identifies and describes the procedures, materials, equipment, and facilities used at the station to minimize the frequency and severity of oil spills. ONS has a spill response procedure requiring all staff to promptly notify and respond to a spill. The procedure also provides a process for investigation and corrective action (Duke 2021a). ONS also has a chemical control program for managing storage areas and assessing and mitigating risk from hazardous and toxic chemicals. These plans, programs, and procedures will remain in place, and they will be updated as necessary during the SPEO.

Through these nonstructural and structural devices, the adverse stormwater-related effects are controlled. These permits and controls will remain in place, and they will be updated as appropriate during the SPEO. Compliance with the current NPDES permit conditions and stormwater regulatory requirements, and implementation of the SWPPP, SPCC Plan, and BMPs will ensure the continued SMALL impact to surface water quality from non-cooling systems. Duke Energy finds that impacts to surface water use (non-cooling system) and quality for the proposed SPEO term are SMALL.

ALTERED CURRENT PATTERNS AT INTAKE AND DISCHARGE STRUCTURES

Affected SLRA Sections:

New ER Section 4.5.7, Altered Current Patterns at Intake and Discharge Structures

4.5.7.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1]

In the GEIS, NRC considered large flow rates associated with cooling system water use as having the potential to alter current patterns. The degree of influence depends on the design and location of the intake and discharge structures and the characteristics of the surface water body. The size of large rivers, lakes, or reservoirs precludes significant current alterations, except in the vicinity of the structures. The effect on currents near the intake and discharge locations is expected to be localized, and any problems would have been mitigated during the early operational period of a plant. Impacts from altered current patterns at intake and discharge structures during the license renewal term were considered to be SMALL for all plants.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL operating nuclear power plants. Altered current patterns would be limited to the area in the vicinity of the intake and discharge structures.

4.5.7.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on altered current patterns at intake and discharge structures since initial license renewal. The Keowee River and the Little River were impounded to construct Lake Keowee to support the Keowee-Toxaway Hydroelectric Project. Lake Keowee serves as the waterbody source for ONS's cooling system. The impoundment delays the flow of these rivers, and the volume of the impoundment is controlled by the Keowee Hydro Station located at Keowee Dam. Water released over the dam flows into Lake Hartwell. There are no modifications in the operation of the ONS cooling system associated with the proposed SPEO term; therefore, no changes in the existing current patterns are anticipated. The ONS SLR ER Section 3.6.1 describes the size of Lake Keowee (Duke 2021a). Additionally, there are no modifications planned that would alter the existing current pattern.

Duke Energy finds that impacts to altered current patterns at intake and discharge structures for the proposed SPEO term would be SMALL.

ALTERED THERMAL STRATIFICATION OF LAKES

Affected SLRA Sections:

New ER Section 4.5.8, Altered Thermal Stratification of Lakes

4.5.8.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

In the GEIS, NRC considered the impacts of continued plant operations on thermal stratification of lakes. Because cooling systems typically withdraw from the deeper, cooler portion of the water column of lakes or reservoirs and discharge to the surface, they have the ability to alter the thermal stratification of the surface water. This is not considered an issue for rivers or oceans because of mixing caused by natural turbulence. Impacts of altered thermal stratification of lakes would be SMALL for all nuclear plants.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. Effects on thermal stratification would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been SMALL at operating nuclear power plants.

4.5.8.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on altered thermal stratification of lakes since initial license renewal. As discussed in the ONS SLR ER Section 2.2.3, ONS has a once-through heat dissipation system (Duke 2021a). For plants on lakes or reservoirs, the thermal effect on stratification is examined periodically through the NPDES permit renewal process. ONS's NPDES permit establishes a thermal discharge limit in accordance with the Clean Water Act (CWA) 316(a), and ONS operates in compliance with the limit. ONS submitted a license renewal application for the permit in 2013 and requested extension of the 316(a) thermal variance with the application. The permit has been administratively extended. The NPDES permit establishes a maximum allowable discharge temperature and a limit for increases of water temperature between the intake and discharge. As discussed in the ONS SLR ER Section 4.6.2.4, Duke Energy has monitored water temperatures below Keowee Dam since 2000, and the temperatures have demonstrated a stable pattern with no exceedances of the temperature standards (Duke 2021a). Monitoring conducted on the Little River show relatively little spatial variability within the Little River watershed, indicating a lack of considerable migration of the ONS thermal plume into the Little River watershed.

As discussed in the ONS SLR ER Section 3.10.1, ONS also conducts CWA 316(a) studies to demonstrate that the thermal discharge established in the NPDES permit is protective of the Lake

Keowee fishery. This included temperature recording and support for continuation of the CWA 316(a) thermal variance. (Duke 2021a)

No modifications associated with the proposed action would alter the discharge structure. ONS will continue to operate under an NPDES permit and monitor temperature as required under the permit.

Duke Energy finds that impacts to thermal stratification of Lake Keowee for the proposed SPEO term would be SMALL.

SCOURING CAUSED BY DISCHARGED COOLING WATER

Affected SLRA Sections:

New ER Section 4.5.9, Scouring Caused by Discharged Cooling Water

4.5.9.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

In the GEIS, NRC considered the impacts of scouring caused by discharged cooling water. The high flow rate of water from a cooling system discharge structure has the potential to scour sediments and redeposit them elsewhere. While scouring is possible during reactor startup, operational periods would typically have negligible scouring. Scouring is expected to occur only in the vicinity of the discharge structure where flow rates are high. Scouring has been observed at only three nuclear power plants and the effects were localized and minor. The NRC reviewed the impacts of scouring caused by discharged cooling water and found the impacts during the license renewal term would be SMALL for all plants.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. Scouring effects would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been SMALL at operating nuclear power plants.

4.5.9.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on scouring caused by discharged cooling water since initial license renewal. As discussed in the ONS SLR ER Section 2.2.3, ONS withdraws cooling water from the Little River arm of Lake Keowee underneath a skimmer wall and discharges on the Keowee River arm of the lake just above the Lake Keowee dam (Duke 2021a). There are no plant operations or modifications planned for the proposed SPEO operating term that would alter discharge patterns.

Duke Energy has not observed any scouring impacts from discharged cooling water. As there are no expected changes in existing current patterns, no scouring impact changes are expected. Additionally, compliance with regulatory, permit, and license requirements would ensure negligible scouring impacts.

Duke Energy finds that impacts to scouring caused by discharged cooling water for the proposed SPEO term would be SMALL.

DISCHARGE OF METALS IN COOLING SYSTEM EFFLUENT

Affected SLRA Sections:

New ER Section 4.5.10, Discharge of Metals in Cooling System Effluent

4.5.10.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

In the GEIS, NRC considered the discharge of metals in cooling system effluents. Heavy metals such as copper, zinc, and chromium can be leached from condenser tubing and other components of the heat exchange system by circulating cooling water. These metals are normally addressed in NPDES permits because high concentrations of them can be toxic to aquatic organisms. During normal operations, concentrations are normally below laboratory detection levels. However, plants occasionally undergo planned outages for refueling with stagnant water remaining in the heat exchange system. Impacts from the discharge of metals in cooling system effluent during the license renewal term would be SMALL for all plants.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. Discharges of metals have not been found to be a problem at operating nuclear power plants with cooling tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. Discharges are monitored and controlled as part of the NPDES permit process.

4.5.10.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on discharge of metals in cooling system effluent since initial license renewal. As described in the ONS SLR ER Section 3.6.1.2.1, chemical additives approved by the SCDHEC are used to control pH, scale, and corrosion in the circulating water system, and to control biofouling of plant equipment (Duke 2021a). Chemical additives are not used in the non-contact cooling water or hydroelectric waste waters discharged at Outfalls 001 and 007, respectively. Process wastewaters are monitored and discharged through permitted outfalls in accordance with the ONS NPDES Permit No. SC0000515 (ONS SLR ER Attachment B). (Duke 2021a) The current NPDES permit authorizes discharges from four external outfalls and two internal outfalls. ONS's NPDES permit does not have metals limits or require monitoring for metals for Outfall 001, the circulating condenser cooling water outfall. However, the SCDHEC reviewed the need for a copper limit in the permit. Duke Energy provided SCDHEC results from 16 sampling events from 2005 to 2009, showing that the copper concentrations in the lake at the intake and the outfall were consistently the same. SCDHEC concluded that there was no reasonable potential to cause or contribute to a water quality violation. SCDHEC also ran a reasonable potential analysis on all other data reported in Duke Energy's application Section 2C, which requires data on the presence and concentration

of various metals. The analysis indicated there was no reasonable potential for any other parameters to cause or contribute to a water quality violation from this outfall's discharge.

Compliance with current and future NPDES regulatory requirements, permit conditions, and BMPs will ensure that the impact of metals in ONS's cooling system effluent continues to be limited to a SMALL impact during the proposed SPEO term.

Duke Energy finds that impacts to discharge of metals in cooling system effluent for the proposed SPEO term would be SMALL.

DISCHARGE OF BIOCIDES, SANITARY WASTES, AND MINOR CHEMICAL SPILLS

Affected SLRA Sections:

New ER Section 4.5.11, Discharge of Biocides, Sanitary Wastes, and Minor Chemical Spills

4.5.11.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

In the 2013 license renewal GEIS, the NRC considered the impact of discharges of biocides, sanitary wastes, and minor chemical spills on surface water quality. The use of biocides is common and is required to control biofouling and nuisance organisms in plant cooling systems. However, the types of chemicals, their amounts or concentrations, and the frequency of their use may vary. Ultimately, any biocides used in the cooling system are discharged to surface water bodies. The discharge of treated sanitary waste also occurs at plants. Discharge may occur via onsite wastewater treatment facilities, via an onsite septic field, or through a connection to a municipal sewage system. Minor chemical spills collected in floor drains are associated with industry in general and are a possibility at all plants. Each of these factors represents a potential impact on surface water quality. The NRC considered the potential impacts of these factors resulting from nuclear plant operations of surface water quality in its GEIS for license renewal. The NRC concluded that nuclear power plant operation under NPDES permits would mitigate impacts from biocides, sanitary wastes, and minor chemical spills to SMALL significance.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. The effects of these discharges are regulated by federal and state environmental agencies. Discharges are monitored and controlled as part of the NPDES permit process. These impacts have been SMALL at operating nuclear power plants.

4.5.11.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on discharge of biocides, sanitary wastes, and minor chemical spills since initial license renewal. The addition of biocides is governed by ONS's NPDES permit (Attachment B to ONS SLR ER), which requires SCDHEC approval. The NPDES permit also addresses the use of other additives and water treatment chemicals. As discussed in the ONS SLR ER Section 3.6.1.2.1, chemical additives approved by the SCDHEC are used to control pH, scale, and corrosion in the circulating water system, and to control biofouling of plant equipment (Duke 2021a). Chemical additives are not used in the non-contact cooling water or hydroelectric wastewaters discharged at Outfalls 001 and 007, respectively. Condenser cleaning is by mechanical means to reduce and prevent fouling of the condenser tubes by circulating sponge balls through the tubes and thus cleaning tubes while

the plant is in operation. As discussed in the ONS SLR ER Section 9.5.3.4, ONS was connected to a municipal sewage treatment system in 2010 and no longer discharges treated wastewater (Duke 2021a).

Sumps within ONS structures and yard drains capture spills and stormwater runoff in operational areas. These drains are routed to ONS's wastewater treatment system for industrial wastewater that involves three chemical treatment ponds (CTPs). These ponds are permitted under the NPDES permit and discharge through Outfall 002. CTP 1 and 2 receive inputs from turbine building sumps, the water treatment room, photographic waste, and chemical metals cleaning waste. Batch mode discharges from CTP 1 and CTP 2 go through CTP 3, which also receives inputs from the standby shutdown facility sump, turbine building sumps, decant monitor tank, turbine building sump monitor tanks, yard drain stormwater runoff, intake dam underdrain system, and reverse osmosis concentrate. CTP 3 has a skimmer boom and a concrete skimmer wall to contain any oil spills from the station. The NPDES permit sets limits and monitoring requirements for Outfall 002.

As described in ONS SLR ER Section 9.5.3.5, ONS has an SPCC plan that identifies and describes the procedures, materials, equipment, and facilities used at the station to minimize the frequency and severity of oil spills. ONS has a spill response procedure requiring all staff to promptly notify and respond to a spill (Duke 2021a). The procedure also provides a process for investigation and corrective action. ONS also has a chemical control program for managing storage areas and assessing and mitigating risk from hazardous and toxic chemicals.

As indicated in the ONS SLR ER Section 9.5.3.6, a review of records showed two spills reported to the National Response Center from 2014 through 2020 (Duke 2021a). On July 20, 2014, approximately 5 gallons of lubricating oil were released from the Keowee Hydro Station. On February 8, 2018, approximately 4 ounces of hydraulic oil were released while testing a submersible hydraulic pump adjacent to the Keowee Hydro Station spillway. Since 2020, two sewage spills have occurred. The first spill, on November 1, 2021, was from either a wastewater sewer system overflow or a pump station failure. The second spill, on August 15, 2022, was due to a failure of both sewage air ejectors for the Maintenance Support Building. Both spills were reported to SCDHEC. ONS has environmental protection programs for the non-radiological hazards of plant operations guided by compliance with state and local environmental permits and requirements. The comprehensive regulatory controls and permits in place and Duke Energy's compliance with them, guided by their internal procedures, would mitigate impacts to surface waters from Duke Energy's continued operations during the proposed SPEO term.

Compliance with current NPDES regulatory requirements and permit conditions and implementation of the SWPPP and BMPs will mitigate impacts from wastewater and stormwater discharges to SMALL.

Duke Energy finds that impacts from discharges of biocides, sanitary wastes, and minor chemical spills for the proposed SPEO term would be SMALL.

SURFACE WATER USE CONFLICTS (PLANTS WITH ONCE-THROUGH COOLING SYSTEMS)

Affected SLRA Sections:

New ER Section 4.5.12, Surface Water Use Conflicts (Plants with Once-Through Cooling Systems)

4.5.12.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

The NRC considered surface water use conflicts resulting from continued operation of plants with once-through cooling systems. Nuclear power plant cooling systems may compete with other users relying on surface water resources, including downstream municipal, agricultural, or industrial users. Once-through and closed-cycle cooling systems have different water consumption rates. Once-through cooling systems return most of their withdrawn water to the same surface water body, with evaporative losses of less than 3 percent. Consumptive use by plants with once-through cooling systems 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. The NRC considered that future water availability could be impacted by climate change and drought. 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. This situation would then necessitate decisions by local, state, and regional water planning officials. The NRC concluded that the impact on water use conflicts from the continued operation and refurbishment activities would be SMALL for plants that utilize once-through cooling.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.

4.5.12.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on surface water use conflicts (plants with once-through cooling systems) since initial license renewal. As discussed in the ONS SLR ER Section 3.6.3.1, ONS returns nearly all of the surface water withdrawals to Lake Keowee. As discussed in ONS SLR ER Section 4.12, Duke Energy has plans for thermal margin recapture rates at 1.6 percent (15 MWe) per unit. (Duke 2021a) Lake Keowee falls under jurisdiction of the U.S. Army Corps of Engineers (USACE). Any increased water consumption due to power uprates must be within the USACE operating agreement (USACE 2014). ONS will comply with the USACE operating agreement during the SPEO period; therefore, any impacts to water consumption due to the uprate will be SMALL.

The future availability of Lake Keowee was studied prior to the development of the 2014 USACE operating agreement. The 2014 USACE Final Environmental Assessment for the new operating agreement studied the entire Savannah River Basin, including Lake Keowee (USACE 2014). The assessment encompassed various lake level studies, impacts of climate change on hydrology sensitivity analysis, and withdrawals and inflows that projected through 2066, considering projected population growth. The agreement, which limits surface water withdrawals from Lake Keowee, has an expiration date of August 2046, to coincide with the expiration of the Federal Energy Regulatory Commission (FERC) license for the Keowee-Toxaway Project. Duke Energy would pursue renewals of the FERC license and continuation of agreements with the USACE regarding water consumption within Lake Keowee.

The average surface water withdrawal rate by ONS in 2018 was reported as 2,578.21 million gallons per day (MGD) and averaged 2,619.15 MGD between 2014 and 2018, as demonstrated in the ONS SLR ER, Table 3.6-4a (Duke 2021a). As shown in Table 4.5-1a, the average ONS surface water withdrawal rate in 2021 was reported as 2,645.14 MGD. Withdrawals averaged 2,628.19 MGD from 2014 through 2021. A summary of monthly surface water withdrawals reported by ONS from 2014 through 2018 is provided in the ONS SLR ER Table 3.6-4b (Duke 2021a), and monthly surface water withdrawals from 2019 through 2021 are provided in Table 4.5-1b. Surface water withdrawal rates have been consistent in 2014 through 2021 and within permit limits.

Compliance with the USACE operating agreement protects downstream users and ecological communities, mitigating water use impacts. Continued compliance with the operating agreement and water use regulatory requirements during the proposed SPEO operating term will minimize impacts to SMALL.

Duke Energy finds that surface water use conflicts for plants with once-through cooling systems for the proposed SPEO term would be SMALL.

Table 4.5-1a ONS Yearly Surface Water Withdrawal Summary (2019-2021)

Year	Monthly Maximum		Monthly Average		Monthly Minimum		Yearly Total	
	MGM	gpm_a	MGM	gpm_a	MGM	gpm_a	MGY	MGD
2019	94,817.03	2,124,037.41	79,442.80	1,813,742.57	56,246.02	1,394,990.58	953,313.54	2,611.82
2020	94,817.03	2,124,037.41	81,579.10	1,861,146.19	60,975.01	1,411,458.56	978,229.16	2,672.76
2021	96,966.02	2,172,177.87	80,456.34	1,836,882.70	56,997.02	1,413,616.57	956,476.13	2,645.14
2014-2021	96,966.02	2,172,178.00	79,828.88	1,824,306.01	53,919.00	1,399,440.00	959,952.78	2,628.19

MGM = Million gallons per month
gpm_a = Average gallons per minute for the month
MGY = Million gallons per year
MGD = Average million gallons per day for the year
(Duke 2021a Table 3.6-4a)

Table 4.5-1b ONS Monthly Surface Water Withdrawal Summary (2019-2021)

Month	Surface Water Withdrawals (MGM)		Total	
	CCW Intake	B5B Emergency Intake Structure	MGM	gpm[a]
January-19	79,940.00	0.01	79,940.01	1,790,770.83
February-19	56,246.00	0.02	56,246.02	1,394,990.58
March-19	63,159.00	0.00	63,159.00	1,414,852.15
April-19	68,781.00	0.02	68,781.02	1,592,153.24
May-19	81,620.00	0.35	81,620.35	1,828,412.86
June-19	84,468.00	0.02	84,468.02	1,955,278.24
July-19	94,810.00	0.02	94,810.02	2,123,880.38
August-19	94,817.00	0.03	94,817.03	2,124,037.41
September-19	91,653.00	0.01	91,653.01	2,121,597.45
October-19	91,373.00	0.02	91,373.02	2,046,886.65
November-19	64,677.00	0.02	64,677.02	1,497,153.24
December-19	81,769.00	0.02	81,769.02	1,831,743.28
January-20	81,564.00	0.01	81,564.01	1,827,150.76
February-20	73,665.00	0.06	73,665.06	1,764,010.06
March-20	73,135.00	0.00	73,135.00	1,638,328.85
April-20	60,975.00	0.01	60,975.01	1,411,458.56
May-20	79,521.00	0.02	79,521.02	1,781,384.86
June-20	87,708.00	0.00	87,708.00	2,030,277.78
July-20	94,817.00	0.00	94,817.00	2,124,036.74
August-20	94,817.00	0.03	94,817.03	2,124,037.41
September-20	91,758.00	0.00	91,758.00	2,124,027.78
October-20	80,225.00	0.01	80,225.01	1,797,155.24
November-20	77,277.00	0.02	77,277.02	1,788,819.91
December-20	82,767.00	0.00	82,767.00	1,854,099.46
January-21	79,846.00	0.01	79,846.01	1,788,665.10
February-21	56,997.00	0.02	56,997.02	1,413,616.57
March-21	62,637.00	0.00	62,637.00	1,403,158.60
April-21	76,847.00	0.01	76,847.01	1,778,865.97
May-21	81,903.00	0.02	81,903.02	1,834,745.07
June-21	83,755.00	0.00	83,755.00	1,938,773.15
July-21	96,405.00	0.01	96,405.01	2,159,610.44
August-21	96,966.00	0.02	96,966.02	2,172,177.87
September-21	93,735.00	0.00	93,735.00	2,169,791.67
October-21	90,948.00	0.01	90,948.01	2,037,365.82
November-21	69,564.00	0.01	69,564.01	1,610,278.01
December-21	75,873.00	0.02	75,873.02	1,699,664.43

EFFECTS OF DREDGING ON SURFACE WATER QUALITY

Affected SLRA Sections:

New ER Section 4.5.13, Effects of Dredging on Surface Water Quality

4.5.13.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

In the GEIS, NRC considered the potential impacts to surface water quality from dredging operations to support nuclear power plant operations. Dredging activities and the discharge of dredged and/or fill material have the potential to impact surface water quality. Nuclear power plants conduct maintenance dredging to remove accumulated sediments in the vicinity of water intakes, canals, and discharge structures, and to maintain barge shipping lanes. The issue does not concern maintenance dredging of onsite cooling ponds and onsite disposal of dredged material (e.g., mud). In general, the NRC found maintenance dredging affects localized areas for a brief period of time. The NRC also recognized that dredging operations are performed under permits issued by the USACE and possibly state or local agencies.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. Dredging to remove accumulated sediments in the vicinity of intake and discharge structures and to maintain barge shipping has not been found to be a problem for surface water quality. Dredging is performed under permit from the USACE and possibly from other state or local agencies.

4.5.13.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on effects of dredging on surface water quality since initial license renewal. ONS does not periodically dredge at Lake Keowee and does not anticipate dredging during the proposed SPEO term. However, should any dredging needs arise for plant operations at ONS, Duke Energy would obtain the necessary federal and state permits. Compliance with regulatory requirements and permit conditions will ensure continued SMALL impact from dredging activities and associated discharges.

Duke Energy finds that impacts of dredging on surface water quality for the proposed SPEO term would be SMALL.

TEMPERATURE EFFECTS ON SEDIMENT TRANSPORT CAPACITY

Affected SLRA Sections:

New ER Section 4.5.14, Temperature Effects on Sediment Transport Capacity

4.5.14.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.1]

The NRC considered this issue in the GEIS by stating: “Increased temperature and the resulting decreased viscosity have been hypothesized to change the sediment transport capacity of water, leading to potential sedimentation problems, altered turbidity of rivers, and changes in riverbed configuration” (NRC 2013a). The NRC’s review indicated that there is no evidence that temperature effects on sediment transport capacity have caused adverse environmental effects at any existing nuclear power plant and acknowledged that regulatory agencies have expressed no concerns regarding the impacts of temperature on sediment transport capacity. Furthermore, because of the small area near a nuclear power plant affected by increased water temperature, it is not expected that plant operations would have a significant impact. Effects are considered to be of SMALL significance for all plants. No change in the operation of the cooling system is expected during the license renewal term, so no change in effects on sediment transport capacity is anticipated.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem.

4.5.14.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on temperature effects on sediment transport capacity since initial license renewal. ONS discharges heated cooling water at a depth of approximately 20 feet with discharge temperature governed by the NPDES permit, as demonstrated in ONS SLR ER Attachment B (Duke 2021a). In compliance with the NPDES permit, ONS monitors surface temperature and water column temperature at sampling points in Lake Keowee, as called for in its SCDHEC-approved CWA 316(a) study plan. SCDHEC reviews the results of 316(a) study plan with each NPDES permit renewal. If SCDHEC has any concerns related to this issue, it would be addressed through the NPDES permitting process. Duke Energy has not observed any sediment transport impacts resulting from discharge temperature. No change in the operation of the cooling system is expected during the proposed SPEO term; therefore, no change in effects on sediment transport capacity is anticipated. Compliance with regulatory, permit, and license requirements would ensure that impacts to surface water resources, including temperature effects on sediment transport capacity, are SMALL.

Duke Energy finds that temperature effects on sediment transport capacity for the proposed SPEO term would be SMALL.

GROUNDWATER CONTAMINATION AND USE (NON-COOLING SYSTEM IMPACTS)

Affected SLRA Sections:

New ER Section 4.5.15, Groundwater Contamination and Use (Non-Cooling System Impacts)

4.5.15.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.2]

In the GEIS, NRC assessed the impacts of groundwater contamination and use due to non-cooling water systems. Among common groundwater uses are extraction or draining of groundwater for dewatering purposes and groundwater extraction for contaminant plume control. Contamination of groundwater and soil can result from leaks or spills of solvents, diesel fuel, gasoline, and other industrial chemicals; heavy metals deposited to soils from industrial activities; leaching of contaminants from wastewater ponds or lagoons; and other sources. The NRC considered the issue in light of the programs and procedures commonly implemented at nuclear plants, including proper chemical and waste storage and handling; secondary containment and leak detection; use of BMPs and SPCC plans; compliance with federal and state regulations and permits; and groundwater monitoring programs. The NRC concluded that implementation of such programs and procedures would serve to mitigate any effects to groundwater use or quality to those of a SMALL impact.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL if BMPs are implemented for handling any materials produced or used during these activities. Extensive dewatering is not anticipated from continued operations and refurbishment associated with license renewal. Industrial practices involving the use of solvents, hydrocarbons, heavy metals, or other chemicals, and/or the use of wastewater ponds or lagoons have the potential to contaminate site groundwater, soil, and subsoil. Contamination is subject to state or EPA-regulated cleanup and monitoring programs.

4.5.15.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on groundwater contamination and use (non-cooling system impacts) since initial license renewal. Groundwater seepage into ONS structures, collected in building sumps, is directed to the ONS conventional wastewater treatment system which consists of three Chemical Treatment Ponds (CTPs). The ONS conventional wastewater treatment system is permitted under the ONS NPDES permit and has eight groundwater monitoring wells installed to assess potential impacts to groundwater. These wells are sampled semi-annually, and results are reported to the SCDHEC, as demonstrated in ONS SLR ER Attachment B, Part III.C.1 (Duke 2021a). Additional monitor

wells onsite are sampled as part of the ONS ground water protection program (GPP), as discussed in ONS SLR ER Section 3.6.4.2 (Duke 2021a). In 2021, 61 additional wells were sampled for tritium as part of the ONS GPP (Duke 2022b). Groundwater quality monitoring and results are described in ONS SLR ER Section 3.6.4.2 (Duke 2021a).

ONS operates a system for groundwater extraction around its standby shutdown facility that has an average flow of 20 gpm. As discussed in ONS SLR ER Section 3.6.3.2, a groundwater flow component exists from the Lake Keowee intake to the east towards Chemical Treatment Pond 3 (CTP 3) and the wastewater conveyance, and an additional groundwater flow component exists from Lake Keowee (at the cooling water discharge structure) to the south toward CTP 3 and the wastewater conveyance. CTP 3 receives approximately 5 to 50 gpm (7,200 to 72,000 gpd) of unaccounted for seepage (not designed as part of the conventional wastewater treatment system), as discussed in ONS SLR ER Section 3.6.1. Since July 2015 through the third quarter of 2020, tritium activity has averaged only 1,280 picoCuries per liter (pCi/L) in groundwater monitoring well GM-7R, the well most proximate to RW-1 and historically exhibiting the more persistent and elevated tritium activity, > 20,000 pCi/L. (Duke 2021a)

In addition to the dewatering and groundwater influx, ONS has also operated a tritium remediation recovery well since 2011 with an approximate average withdrawal rate of 9 gpm, as discussed in ONS SLR ER Section 3.6.3.2 (Duke 2021a). Increased groundwater withdrawals are not planned for the proposed SPEO term. Given that ONS consistently withdraws only small amounts of groundwater for structure dewatering and tritium remediation with no expected increases in withdrawal volume, no significant adverse impacts from groundwater use from non-cooling systems are anticipated during the proposed SPEO term and impacts to groundwater resources are anticipated to be SMALL.

Impacts to groundwater quality could result from ground-disturbing activities and stormwater infiltration. As presented in Section 4.4, Duke Energy complies with stormwater regulations, obtains necessary stormwater permits, and develops SWPPPs and implements BMPs which ensures the continued SMALL impact to surface water quality from non-cooling systems.

As presented in ONS SLR ER Section 9.5.3.5, ONS also has a 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. From 2014 to August 2022, ONS had no reportable spills with the potential to impact groundwater resources. The above-mentioned spills occurring between 2014 and August 2022 that were discharged to surface waters were discussed in Section 4.5.11.2 (Duke 2021a).

As discussed in ONS SLR ER Section 9.4, no remediation activities for nonradioactive environmental concerns have been conducted since 2014 or are ongoing (Duke 2021a). In addition, ONS operates on-site underground storage tanks in compliance with state regulations

designed to protect soil and groundwater resources, as presented in ONS SLR ER Section 9.5.13.4 (Duke 2021a). ONS has a closed and capped Class 2 landfill with leachate monitoring permitted by the SCDHEC, as presented in Table 9.1-1 of the ONS SLR ER. (Duke 2021a)

ONS is subject to federal, state, and local regulations and has programs and procedures that minimize the potential for groundwater contamination. Continuation of groundwater monitoring to detect contamination in order to correct leaks, and compliance with current and future spill control regulatory requirements, will protect against inadvertent spills and releases and detect and prompt action to mitigate leaks.

Duke Energy finds that impacts to groundwater contamination and use (non-cooling system impacts) for the proposed SPEO term would be SMALL.

GROUNDWATER USE CONFLICTS (PLANTS THAT WITHDRAW LESS THAN 100 GALLONS PER MINUTE)

Affected SLRA Sections:

New ER Section 4.5.16, Groundwater Use Conflicts (Plants that Withdraw Less than 100 Gallons per Minute)

4.5.16.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.2]

Water wells are used by nuclear power plants for their potable water system, landscape watering, and at some plants, groundwater is the source for the makeup and service water systems. The pumping of groundwater creates a cone of depression in the potentiometric surface around the pumping well. The amount the water table or potentiometric surface declines and the overall extent of the cone depend on the pumping rate, characteristics of the aquifer (e.g., its permeability), whether the aquifer is confined or unconfined, and certain boundary conditions (including the nearby presence of a hydrologically connected surface water body). Generally, plants with a peak withdrawal rate of less than 100 gpm do not have a significant cone of depression. Their potential for causing conflict with other groundwater users would depend largely on the proximity of the other wells.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. Plants that withdraw less than 100 gpm are not expected to cause any groundwater use conflicts.

4.5.16.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on groundwater use conflicts (plants that withdraw less than 100 gallons per minute) since initial license renewal. As presented in ONS SLR ER Section 4.5.15.4, ONS operates a well system for groundwater extraction around its standby shutdown facility that has an average flow of 20 gpm (Duke 2021a). Since 2010, ONS has also operated a tritium remediation recovery well with an approximate average withdrawal rate of 9 gpm.

As mentioned above in Section 4.5.15, increased groundwater withdrawals are not planned for the proposed SPEO operating term. ONS borders Lake Keowee, a hydrologically connected surface water body, as discussed in ONS SLR ER Section 3.6.2.3. No registered private water wells are located within a two-mile band around the ONS property boundary, and one public drinking water supply well for an RV park is located approximately 1.3 miles from ONS across Lake Keowee, as presented in ONS SLR ER Section 3.6.3.2. (Duke 2021a)

Given that ONS consistently withdraws only small amounts of groundwater for structure dewatering and tritium remediation with no expected increases in withdrawal volume, groundwater use conflicts are not anticipated for the proposed SPEO operating term. Thus, the impact of continued groundwater use by ONS would be SMALL.

Duke Energy finds that impacts to groundwater use conflicts (plants that withdraw less than 100 gpm) for the proposed SPEO term would be SMALL.

GROUNDWATER QUALITY DEGRADATION RESULTING FROM WATER WITHDRAWALS

Affected SLRA Sections:

New ER Section 4.5.17, Groundwater Quality Degradation Resulting from Water Withdrawals

4.5.17.1 Generic Analysis for Initial License Renewal [GEIS Section 4.5.1.2]

In the 2013 license renewal GEIS, the NRC reviewed groundwater drawdown due to water withdrawals, which can draw water into the aquifer. If the water is of lower quality, this poses the possibility of groundwater degradation. Further, wells in a coastal setting (e.g., ocean shore or estuary) have the potential to cause saltwater intrusion into the aquifer. The degree of saltwater intrusion depends on the cumulative pumping rates of wells, their screen depths, and hydrogeologic conditions.

The NRC recognized that nuclear power plants are not the large-volume groundwater users that would be a leading driver for saltwater intrusion in the plant's locale. The NRC concluded that groundwater withdrawals by nuclear power plants would have a SMALL impact on groundwater quality.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. Groundwater withdrawals at operating nuclear power plants would not contribute significantly to groundwater quality degradation.

4.5.17.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on groundwater quality degradation resulting from water withdrawals since initial license renewal. The groundwater pumping rates, dewatering, and groundwater influx are detailed above in Sections 4.5.15 and 4.5.16. The largest volume of groundwater removal discussed above is due to the presumed groundwater influx into CTP 3, as discussed in ONS SLR ER Section 3.6.1. Also, as detailed above in Section 4.5.15, groundwater investigations indicated groundwater flow from Lake Keowee toward CTP 3. Both Lake Keowee and the ONS site's underlying groundwater are freshwater, as discussed in ONS SLR ER Section 3.6.4.2, so ONS's activities and wastewater ponds would not be drawing water of poorer quality into the groundwater zones underlying ONS. (Duke 2021a)

ONS consistently withdraws only small amounts of groundwater for structure dewatering and tritium remediation with no expected increases in withdrawal volume. Therefore, groundwater

quality degradation due to groundwater withdrawals are not anticipated for the proposed SPEO term.

Duke Energy finds that impacts to groundwater quality degradation resulting from water withdrawals for the proposed SPEO term would be SMALL.

EXPOSURE OF TERRESTRIAL ORGANISMS TO RADIONUCLIDES

Affected SLRA Sections:

New ER Section 4.6.7, Exposure of Terrestrial Organisms to Radionuclides

4.6.7.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.1]

In the 2013 license renewal GEIS, the NRC considered the potential for radionuclides from normal operations to impact terrestrial organisms and concluded that impacts on terrestrial biota would be SMALL. In its review, the NRC considered the various pathways that radionuclides may be released from nuclear power plants into the environment. Releases into terrestrial environments often result from deposition of small amounts of radioactive particulates released from power plant vents during normal operations. These releases typically include krypton, xenon, and argon (which do not contain radioactive particles), tritium, isotopes of iodine, and cesium, and they may also include strontium, cobalt, and chromium. Radionuclides may also be released into the aquatic environment from the liquid effluent discharge line. Radionuclides that enter shallow groundwater from cooling ponds can be taken up by terrestrial plant species, including both upland species and wetland species, where wetlands receive groundwater discharge. Terrestrial biota may be exposed to ionizing radiation from radionuclides through direct contact with water or other media, inhalation, or ingestion of food, water, or soil.

As part of the 2013 GEIS analysis, the NRC conducted a review of all operating nuclear power plants to evaluate the potential impacts of radionuclides on terrestrial biota from continued operations. The NRC selected 15 representative plants to calculate estimated dose rates for terrestrial biota from nuclear plants. The maximum estimated dose rate calculated for any of the nuclear power plants was 0.0354 rad per day (rad/d) (3.54 x 10-4 Gray per day [Gy/d]) (riparian animal at the Browns Ferry plant), which is below the guideline value of 0.1 rad/d (0.001 Gy/d) for a riparian animal receptor. On the basis of these calculations and a review of the available literature, the NRC concluded that the impact of routine radionuclide releases from past and current operations and refurbishment activities on terrestrial biota would be SMALL for all nuclear plants.

For initial license renewals, the NRC codified its conclusion that impacts of exposure of terrestrial organisms to radionuclides are expected to be SMALL from routine radionuclide releases. Doses to terrestrial organisms from continued operations and refurbishment associated with license renewal are expected to be well below exposure guidelines developed to protect these organisms.

4.6.7.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on exposure of terrestrial organisms to radionuclides since initial license renewal. The ONS radiological environmental monitoring program (REMP) has been conducted since before power operations began at the plant. This program monitors and documents radiological impacts by measuring radiation and radioactive materials with potential exposure pathways and confirms measurable concentrations of radioactive effluent releases do not exceed expected concentrations within the environment. Duke Energy also monitors radioactivity levels by collecting samples of air, drinking water, surface water, shoreline sediment, fish, milk, and broadleaf vegetation, and collects direct radiation exposure using thermoluminescent dosimetry (TLD) at various sampling locations. As mentioned in Section 2.0 of the ONS SLR ER, these are compared to control samples that are collected from areas not subject to the influence of ONS or any other nuclear facility. (Duke 2021a, Duke 2021b) Duke Energy prepares an annual radiological environmental operating report (AREOR) for ONS for submittal to NRC. The most recent results from 2021 were within the ranges of radioactivity concentrations observed in the past. Radioactivity concentrations in drinking water, surface water, fish, and shoreline sediment attributable to station operation were within selected licensee commitment levels which are selected for evaluation and trending. Further, environmental radiological monitoring data is consistent with effluents introduced into the environment by plant operations. From the review of these results, Duke Energy concluded that the continued operation of ONS has not contributed measurable radiation or the presence of gamma radioactivity in the environmental media monitored. The surface water and drinking water samples revealed tritium concentrations that are well within the applicable regulatory limits. The radiological environmental data for 2021 indicates that radioactivity concentrations were not higher than expected and all positively identified measurements attributable to ONS operations in 2021 were within limits as specified in the ONS ODCM, thus, presenting no significant impact on the environment or public safety, as presented in ONS SLR ER Section 3.10.3. (Duke 2022b)

ONS operates in accordance with its license. Releases are maintained in compliance with 10 CFR Part 20 limits and reported in annual radioactive effluent release reports submitted to the NRC. Continued compliance with NRC radiological effluent limits and implementation of the REMP during the SPEO term will ensure that terrestrial organisms' exposure to radionuclides is well within guidelines, and adverse trends are detected in order to implement corrective actions.

Duke Energy finds that impacts of exposure of terrestrial organisms to radionuclides for the proposed SPEO term would be SMALL.

COOLING SYSTEM IMPACTS ON TERRESTRIAL RESOURCES (PLANTS WITH ONCE-THROUGH COOLING SYSTEMS OR COOLING PONDS)

Affected SLRA Sections:

New ER Section 4.6.8, Cooling System Impacts on Terrestrial Resources (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.8.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.1]

The NRC considered the potential impacts to terrestrial resources from contaminants and physical alterations of the environment resulting from the operation of the cooling system. Physical alterations include increased water temperatures; humidity and fogging; contaminants in surface water or groundwater; and disturbance of wetlands from maintenance dredging of onsite cooling ponds, disposal of dredged material from such dredging, and erosion of shoreline wetlands. Other potential impacts to terrestrial resources considered in this issue include impingement of waterfowl at the cooling water intakes, potential for groundwater quality degradation by contaminants present in cooling ponds and cooling canals, and reduced water availability due to surface water or groundwater withdrawals.

The 2013 GEIS stated no adverse effects on terrestrial plants or animals have been reported as a result of increased water temperatures, fogging, humidity, or reduced habitat quality. Because of the low concentrations of contaminants within the liquid effluents associated with the cooling systems, the uptake and accumulation of contaminants in the tissues of wildlife exposed to the contaminated water or aquatic food sources are not expected to be a significant issue, and the impacts are expected to be SMALL for all plants. Potential mitigation measures would include regular monitoring of the cooling systems for water quality and measures to exclude wildlife from contaminated ponds. On the basis of these considerations, the NRC concluded that the impact of continued operation of the cooling systems on terrestrial resources would be SMALL for all nuclear plants.

For initial license renewals, the NRC codified its conclusion that impacts of cooling systems from contaminants and physical alterations on terrestrial resources (plants with once-through cooling systems or cooling ponds) are expected to be SMALL. No adverse effects to terrestrial plants or animals have been reported as a result of increased water temperatures, fogging, humidity, or reduced habitat quality. Due to the low concentrations of contaminants in cooling system effluents, uptake, and accumulation of contaminants in the tissues of wildlife exposed to the contaminated water or aquatic food sources are not expected to be significant issues.

4.6.8.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) since initial license renewal. The NRC identified certain activities or conditions for impacts to terrestrial resources as a consequence of operation of a plant's cooling water system. The cooling water system is described in ONS SLR ER Section 2.2.3.3 (Duke 2021a). Duke Energy does not plan to conduct refurbishment and plans to continue to operate the cooling water system as currently configured through the proposed SPEO. These activities or conditions are identified below along with ONS-specific information.

- Physical alterations including increased water temperatures, humidity, and fogging.
    - As discussed in Section 9.3 of the ONS SLR ER, ONS's NPDES permit establishes conditions for operation of the cooling water system based on ambient water temperature of Lake Keowee and discharge temperature limits. These permit conditions limit the extent that discharge temperature can be above ambient, minimizing humidity and fogging. There have been no notices of violations related to the NPDES permit with respect to discharge temperatures in the past five years (Duke 2021a).
- Reduced water availability due to surface water use.
    - The cooling water source is Lake Keowee. The ONS surface water withdrawal permit, issued by the State of South Carolina (SCDHEC Permit # 37PN001) requires annual reporting of surface water withdrawal by ONS and allows for the total withdrawal amount of 94,885 MGM from the CCW and B5B intakes.
- Contaminants in surface water.
    - Discharges are governed by ONS' NPDES permit, which details monitoring requirements and daily/monthly discharge limitations at the site. As stated in ONS SLR ER Section 9.3, based on a review of records for the last five years, there was one notice of violation related to the NPDES permit that was eventually rescinded (Duke 2021a). SCDHEC issued a NOV for 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. One additional NOV was received regarding an oil & grease exceedance for Outfall 002 in December 2020. ONS investigated the site for any potential conditions or issues that could have caused the oil & grease exceedance, and none were identified. ONS immediately collected four additional follow-up samples in December 2020. All follow-up oil & grease samples were reported below detectable limits. No additional actions were required by SCDHEC. There have been no other notices of violations related to contaminants in surface water.

- Reduced water availability due to groundwater withdrawals.
    - Not applicable to ONS because the cooling water source is Lake Keowee, not groundwater.
- Contaminants in groundwater; potential for groundwater quality degradation by contaminants present in cooling ponds and cooling canals.
    - Not applicable to ONS because the cooling system does not have cooling ponds or cooling canals.
- Disturbance of wetlands from maintenance dredging of onsite cooling ponds, disposal of dredged material from such dredging.
    - Not applicable to ONS because the cooling system does not have cooling ponds or cooling canals.
    - ONS does not periodically dredge (Section 4.5.13.2), and no dredging is anticipated during the SPEO term.
- Erosion of shoreline wetlands.
    - Development/ construction activities along the Lake Keowee shoreline and erosion control measures are subject to the requirements of Duke Energy's Shoreline Management Plan for the Keowee-Toxaway project which includes shoreline classification maps, classifications and lake-use restrictions, and shoreline management guidelines (Duke 2014). Figure 3.7-2 shows the National Wetlands Inventory mapped wetlands within the ONS site. There are no wetlands where the discharge is located, or on the shoreline of Lake Keowee itself.
- Impingement of waterfowl at the cooling water intakes.
    - None of the recorded bird deaths/injuries occurring between 2014 and May 2022 was a result of impingement at the intake. Further, as discussed in ONS SLR ER Section 4.6.1.4, cooling water is withdrawn from beneath a submerged skimmer wall and passed through fixed screens. There is no fish return system. Screens are removed and backwashed when they require cleaning. Debris from the screens is collected and disposed of at a licensed landfill. The intake structure as designed does not have features that would encourage birds to forge at the intake and risk impingement. (Duke 2021a)

In summary, adequate regulatory controls are in place to ensure that terrestrial resources are protected during the proposed ONS SPEO term.

Duke Energy finds that impacts from cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) for the proposed SPEO term would be SMALL.

BIRD COLLISIONS WITH PLANT STRUCTURES AND TRANSMISSION LINES

Affected SLRA Sections:

New ER Section 4.6.9, Bird Collisions with Plant Structures and Transmission Lines

4.6.9.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.1]

In the 2013 license renewal GEIS, the NRC considered the impact on avian mortality from birds colliding with cooling towers and transmission lines by reviewing the primary literature for avian collision mortality associated with all types of man-made objects, as well as the results of monitoring studies conducted at six nuclear plants. The NRC found that collision mortality associated with nuclear plant structures and transmission lines represents only a fraction of the total annual bird collision mortality from all man-made sources. In addition, there are no reports of relatively high collision mortality occurring at the transmission lines associated with nuclear power plants in the United States.

For initial license renewals, the NRC codified its conclusion that impacts of bird collisions with plant structures and transmission lines are expected to be SMALL. Bird collisions with cooling towers and other plant structures and transmission lines occur at rates that are unlikely to affect local or migratory populations and the rates are not expected to change.

4.6.9.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on bird collisions with plant structures and transmission lines since initial license renewal. Transmission lines that connect the plant to the transmission system are only those lines from the ONS turbine building to the 230-kV and the 525-kV switchyards, as noted in ONS SLR ER Section 2.2.5.1 (NRC 1999; Duke 2021a). All in-scope transmission lines are located completely within the ONS site, as shown in Figure 2.2-4 of ONS SLR ER (Duke 2021a).

Duke Energy provides protection to migratory, and threatened and endangered birds through a corporate avian protection plan. This plan adheres to the Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service (USFWS) guidelines regarding birds and electrical energy. As discussed in ONS SLR ER Section 2.2.5.3, Duke Energy's avian protection plan also provides construction design standards for avian-safe structures and mortality reduction measures. (Duke 2021a)

Avian deaths are recorded at ONS. Per procedure, Duke Energy environmental staff are contacted so that any necessary notifications to appropriate agencies can be made. Records of avian deaths from 2014 to September 2022 show 25 dead or injured birds. The cause of death for several birds

was identified as collision. (Duke 2021a) This low occurrence of avian deaths would indicate that none of the ONS structures have a significant impact on the local or migratory bird populations. Further, ONS has no cooling towers and ONS has not proposed any refurbishment activities or construction of new facilities related to SPEO term. As such, bird collisions with plant structures and transmission lines during the proposed SPEO term would be low.

Continued monitoring of avian deaths and implementation of mitigation measures outlined in the avian protection plan will reduce the risk of avian death from collision with plant structures and minimize impacts. Given the small number of bird mortalities/injuries over several years, the impacts of bird collisions with plant structures and transmission lines are expected to be minimal.

Duke Energy finds that impacts of bird collisions with plant structures and transmission lines for the proposed SPEO term would be SMALL.

TRANSMISSION RIGHT-OF-WAY MANAGEMENT IMPACTS ON TERRESTRIAL RESOURCES

Affected SLRA Sections:

New ER Section 4.6.10, Transmission Line Right-of-Way Management Impacts on Terrestrial Resources

4.6.10.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.1]

The NRC considered the impacts of transmission line right-of-way (ROW) management on terrestrial resources and found that although the initial habitat destruction associated with ROW clearing can have numerous consequences on wildlife populations, the proper management of transmission line ROW areas does not have significant adverse impacts on current wildlife populations and that ROW management can provide valuable wildlife habitats. The NRC noted that continued ROW management during the license renewal term will not lower habitat quality or cause significant changes in wildlife populations in the surrounding habitat. Therefore, the NRC concluded that the impact of continued transmission line ROW management on terrestrial resources is SMALL for all nuclear plants.

For initial license renewals, the NRC codified its conclusion that transmission line right-of-way management impacts on terrestrial resources are expected to be SMALL. Continued ROW management during the license renewal term is expected to keep terrestrial communities in their current condition. Application of BMPs would reduce the potential for impacts.

4.6.10.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on transmission right-of-way management impacts on terrestrial resources since initial license renewal. In-scope transmission lines at ONS are discussed in the ONS SLR ER Section 2.2.5.1 and depicted in Figure 2.2-4. The lines are confined to the ONS site and cross developed areas. The short distances of in-scope transmission lines indicate this issue would not be considered significant for ONS. (Duke 2021a)

As discussed in the ONS SLR ER Section 3.7.2.6, no designated critical habitat (DCH) areas for endangered species exist at ONS or adjacent to associated transmission lines (Duke 2021a; USFWS 2019). The in-scope transmission corridors do not cross any state or federal parks. Mechanical mowing and selective herbicide application are the predominate methods for corridor maintenance. In areas where mowing is impractical or undesirable (e.g., wetlands and densely vegetated areas), hand cutting and/or non-restricted use herbicides are employed. (Duke 2021a)

ONS has administrative policies and implements BMPs for preventing erosion from soil disruption related to maintenance and management. The NPDES permit requires ONS to implement BMPs to protect surface water and groundwater from runoff of pollutants and loose soil in industrial areas.

The transmission line ROW is highly developed and has very few ecological resources present. Due to the high levels of disturbance and human presence, wildlife use of the ROW is likely to remain minimal. Because of the highly mobile nature of most wildlife species, any potential displacement from corridor management will be temporary.

In summary, the in-scope transmission corridor is developed and industrialized, with limited ecological features. Management of the corridor is not likely to affect terrestrial resources. Implementation of BMPs will ensure continued minimal impact on terrestrial resources from ROW management and maintenance.

Duke Energy finds that transmission line right-of-way management impacts on terrestrial resources for the proposed SPEO term would be SMALL.

ELECTROMAGNETIC FIELDS ON FLORA AND FAUNA (PLANTS, AGRICULTURAL CROPS, HONEYBEES, WILDLIFE, LIVESTOCK)

Affected SLRA Sections:

New ER Section 4.6.11, Electromagnetic Fields on Flora and Fauna (Plants, Agricultural Crops, Honeybees, Wildlife, Livestock)

4.6.11.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.1]

In the 2013 license renewal GEIS, the NRC reviewed the impacts of EMFs on flora and fauna and concluded that no significant impacts of EMFs emitted on terrestrial biota have been identified. Although foliage very close to lines can be damaged, the overall productivity and reproduction of native and agricultural plants appear unaffected. Also, no evidence suggests significant impacts on individual animals or wildlife populations that are chronically exposed to EMFs under transmission lines or in the towers. Livestock behavior and production also appear unaffected by line operation. Therefore, the potential impact of EMFs on terrestrial biota is expected to be of SMALL significance for all plants.

For initial license renewals, the NRC codified its conclusion that impacts of electromagnetic field on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) are expected to be SMALL under normal operating conditions at nuclear power plants. No significant impacts of EMFs on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.

4.6.11.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) since initial license renewal. In-scope transmission lines are confined to the ONS site and cross developed areas, spanning the short distance between the generating units and the switchyards, as depicted in ONS SLR ER Figure 2.2 4 (Duke 2021a). Therefore, the in-scope lines are not crossing agricultural fields, pastures, and wildlife habitat, and exposure to flora and fauna from EMFs due to the in-scope transmission lines would be incidental and minimal.

As described in Section 2.2.5.1 of the ONS SLR ER, the in-scope transmission lines at ONS are 230 kV and 525-kV. In the spring of 2022, a swarm of honeybees was discovered on PCB (Power Circuit Breaker)-54 in the 525-kV Switchyard. DE Transmission personnel notified Nuclear Environmental Field Support (NEFS) of this discovery, and NEFS contacted a qualified beekeeper, and the swarm of honeybees was relocated offsite to a beekeeper farm.

ONS has not proposed any refurbishment activities or construction of new facilities related to SPEO term. (Duke 2021a) The NRC's 2013 literature search on the issue indicated that the EMFs produced by operating transmission lines up to 1,100 kV have not been reported to have any biologically or economically significant impact on plants, wildlife, agricultural crops, or livestock. (NRC 2013a).

Given that the in-scope transmission lines are confined to developed areas and are of a voltage not reported to have any biologically significant impact on plants, wildlife, agricultural crops, or livestock, the EMFs emitted by the ONS in-scope transmission lines would have no impact on flora and fauna. Consequently, impacts on terrestrial flora and fauna due to EMF exposure from the in-scope transmission lines are anticipated to be SMALL during the proposed SPEO term.

Duke Energy finds that impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) for the proposed SPEO term would be SMALL.

ENTRAINMENT OF PHYTOPLANKTON AND ZOOPLANKTON (ALL PLANTS)

Affected SLRA Sections:

New ER Section 4.6.12, Entrainment of Phytoplankton and Zooplankton (All Plants)

4.6.12.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

In the 2013 license renewal GEIS, the NRC reviewed the entrainment of phytoplankton and zooplankton and found that due to no change in operation of the cooling system during the license renewal term, no change in effects on entrainment of phytoplankton and zooplankton was anticipated. Therefore, the NRC determined that entrainment of phytoplankton and zooplankton is expected to have a SMALL impact on populations of these organisms in source waterbodies for all plants.

For initial license renewals, the NRC codified its conclusion that impacts of entrainment of phytoplankton and zooplankton are expected to be SMALL under normal permitted operating conditions at nuclear power plants.

4.6.12.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on entrainment of phytoplankton and zooplankton since initial license renewal. As mentioned in ONS SLR ER Section 3.7.1.1, phytoplankton and zooplankton studies in Lake Keowee began in mid-1973 by Duke Energy biologists in accordance with the NRC's technical specifications for ONS. Studies were halted for a period and began again in 1989. Phytoplankton communities in Lake Keowee are small but highly diverse and viable. The zooplankton community in Lake Keowee consists entirely of microcrustaceans and rotifers. While densities of zooplankton communities in Lake Keowee were observed to decline between 2006-2011, this was attributed to normal aging processes of the lake (Duke 2021a). The lake itself continues to provide support for highly diverse and viable zooplankton communities. The diversity, abundance, and tolerances of zooplankton are indicators of the health of an aquatic system. (Duke 2021a)

Phytoplankton and zooplankton play a vital role in the well-being of the lake, serving as importance food sources. Zooplankton play further role in the aquatic food web as they act to regulate productivity by working as secondary producers. They are the primary food source of small fish that occur in aquatic systems, thereby feeding a majority of the food web. As discussed in ONS SLR ER Sections 3.7.1.1 and 4.6.2.4, Lake Keowee fishery resources have been monitored by various entities, such as USFWS, SCDNR, and Duke Energy, since 1971. As discussed under ONS SLR ER Section 3.7.7.1, studies were also conducted from 2012–2019 to determine the

effects of ONS's thermal discharge on the aquatic biological community of Lake Keowee. During this time, overall water temperatures and dissolved oxygen levels were within historical ranges and remained at levels that could support a warmwater fish community, similar to other South Carolina piedmont reservoirs. Results indicate that phytoplankton species diversity remained high, thus supporting a diverse aquatic biological community. The abundance and diversity of zooplankton species also remained similar to previous studies. Analysis of the collected data indicate the Lake Keowee fish community to be balanced and diverse. The fish community structure indicates a healthy aquatic system. 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 ONS SLR ER Section 4.6.2.4, 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. (Duke 2021a). Continued NPDES monitoring at ONS since then has not detected any changes in Lake Keowee that would alter the conclusions drawn since the last NPDES permit renewal application in 2013.

There are no modifications associated with the proposed action that would alter the intake structure. ONS will continue to operate under a NPDES permit and monitor the fishery as required under the permit. Studies indicate the fishery to be balanced, diverse, stable, and healthy. ONS's continued operation in compliance with its NPDES permit is not expected to adversely affect the aquatic community during the proposed SPEO term.

Duke Energy finds that impacts of entrainment of phytoplankton and zooplankton (all plants) for the proposed SPEO term would be SMALL.

INFREQUENTLY REPORTED THERMAL IMPACTS (ALL PLANTS)

Affected SLRA Sections:

New ER Section 4.6.13, Infrequently Reported Thermal Impacts (All Plants)

4.6.13.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

In the 2013 license renewal GEIS, the NRC reviewed infrequently reported thermal impacts for all nuclear plants. Potential effects common to the operation of nuclear power plant cooling systems considered by NRC in the license renewal GEIS as infrequently reported thermal impacts are listed below, along with a description of the effect. The mitigation measures identified for the thermal effect are also included in the description and/or the standard used by NRC to classify the impacts of the effect as being of SMALL significance. The NRC's review revealed only SMALL levels of impact in the aquatic resources due to the infrequently reported thermal impacts and expects the same at all plants.

For initial license renewals, the NRC codified its conclusion that infrequently reported thermal impacts (all plants) are expected to be SMALL under normal operating conditions at nuclear power plants. Continued operations during the license renewal term are expected to have small thermal impacts with respect to the following:

Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem.

Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem.

Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms.

Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem.

Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem.

4.6.13.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on infrequently reported thermal impacts (all plants) since initial license renewal.

Cold shock: ONS is located in South Carolina and does not experience the low water temperatures characteristic of cold shock events experienced at other nuclear power plants, even if the thermal effluent was suddenly stopped.

Thermal discharge: Lake Keowee is a large reservoir and heated water is discharged at a depth of about 20 feet. As part of Duke Energy's CWA Section 316(a) studies, temperature is recorded to study the influence of the discharge both on surface temperatures and on the vertical water column. ONS's NPDES permit establishes a maximum allowable discharge temperature and a limit for increases of water temperature between the intake and discharge. As discussed in the ONS SLR ER Section 4.6.2.4, Duke Energy has monitored water temperatures below Keowee Dam since 2000, and the temperatures have demonstrated a stable pattern with no exceedances of the temperature standards (Duke 2021a).

Thermal plumes: Temperature recordings and plots do not indicate that there are thermal barriers with the influence of the discharge not being significant in deeper waters and shallower waters with distance from the discharge structure. As discussed under the ONS SLR ER Sections 3.7.7.1 and 4.6.2.4, impacts of the thermal plume were studied 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. 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. (Duke 2021a)

Premature emergence of aquatic organisms: All the macroinvertebrates and fish species found in Lake Keowee are common species widely distributed in the region. (NANFA 2019; NCWRC 2019; SCDNR 2022a; SCDNR 2022b) As described above, the NRC did not describe any occurrences of accelerated development of aquatic insect maturation at nuclear power plants and acknowledged that the literature search indicated it had not been observed in field investigations. Regarding the stimulation of aquatic worms discussed in the 2013 GEIS as occurring at ONS, the phenomenon dates to the 1980s, and the NRC has three times determined that the proliferation of this nuisance species did not result in a significant impact (NRC 1996; NRC 1999; NRC 2013a). No information since publication of the 2013 GEIS is known to Duke Energy biologists on this phenomenon and no additional information on this issue is known.

Stimulation of nuisance organisms: As discussed in the ONS SLR ER Section 3.7.1.1, Asian clams have been documented in Lake Keowee. Asian clams are monitored at the intake canal and

skimmer wall locations near ONS with indications of a low potential for biofouling (Duke 2021a). Other nuisance species known in Lake Keowee are hydrilla (*Hydrilla verticillata*), the common carp (*Cyrpinus carpio*), and green sunfish (*Lepomis cyanellus*). None of these species have proliferated to such levels to promote Duke Energy to initiate procedures or programs for invasive species control.

For plants on lakes or reservoirs, the thermal effect of the discharge is examined periodically through the NPDES permit renewal process. ONS's NPDES permit establishes a thermal discharge in accordance with CWA 316(a) and ONS operates in compliance with the limit. ONS also conducts CWA 316(a) studies to demonstrate that the thermal discharge established in the NPDES permit is protective of the Lake Keowee fishery. As discussed in the ONS SLR ER Sections 3.7.1.1 and 4.6.2.4, Lake Keowee fishery resources have been monitored by various sources (USFWS, SCDNR, and Duke Energy) since 1971. Analysis of the collected data indicated the Lake Keowee fish community to be balanced and diverse. The fish community structure indicates a healthy aquatic system. 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. (Duke 2021a) Continued monitoring at the site has not detected any changes in Lake Keowee that would alter the conclusions drawn since the submittal of the last permit renewal application in 2013.

There are no modifications associated with the proposed action that would alter the discharge structure and ONS will continue to operate under a NPDES permit and monitor temperature and the fishery as required under the permit. As presented above, the ONS SLR ER Sections 3.7.1.1 and 4.6.2.4 discuss that Lake Keowee fishery resources have been monitored by various entities, including USFWS, SCDNR, and Duke Energy, and have concluded Lake Keowee's fishery to be balanced, diverse, stable, and healthy based on current studies and trends (Duke 2021a). ONS's continued operation in compliance with its NPDES permit and future renewal NPDES permits is not expected to adversely affect the fishery during the proposed SPEO term.

Duke Energy finds that impacts to infrequently reported thermal impacts (all plants) for the proposed SPEO term would be SMALL.

EFFECTS OF COOLING WATER DISCHARGE ON DISSOLVED OXYGEN, GAS SUPERSATURATION, AND EUTROPHICATION

Affected SLRA Sections:

New ER Section 4.6.14, Effects of Cooling Water Discharge on Dissolved Oxygen, Gas Supersaturation, and Eutrophication

4.6.14.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

In the 2013 license renewal GEIS, the NRC reviewed the potential effects on aquatic biota from low dissolved oxygen levels, gas supersaturation (gas bubble disease), and eutrophication for nuclear power plant cooling water discharges. The addition of a heat load to an aquatic ecosystem via the discharge of cooling water has the potential to stress aquatic biota by simultaneously increasing metabolic rates and the need for oxygen and by reducing dissolved oxygen concentrations to sub-optimal levels. The potential for effects on biota from a reduction in the dissolved oxygen concentration is greater in ecosystems where dissolved oxygen levels are already approaching sub-optimal levels as a result of other factors that affect the environment. Thus, organisms in ecosystems where (1) the biological demand for dissolved oxygen is elevated as a result of increased levels of detritus or nutrients (e.g., eutrophication from runoff containing fertilizers or manure or from the release of dead, entrained organisms in the discharge of once-through cooling systems); or (2) low flow levels and high ambient temperatures already exist (e.g., as a result of drought conditions or hot weather) may be more susceptible to negative effects if dissolved oxygen levels are reduced further. For this reason, the EPA and states often regulate dissolved oxygen to ensure that minimum levels will be maintained.

In addition to the effects of cooling systems on dissolved oxygen described above, the NRC considered the potential for impacts to aquatic organisms from gas bubble disease. The rapid heating of water in the condenser cooling system also decreases the solubility and saturation point for other dissolved gases. Thus, as the water passing through the cooling system is heated, the water becomes supersaturated with gases. Although the levels of dissolved gases will return to normal values as the water cools and mixes with ambient waters, tissues of aquatic organisms that remain in the supersaturated effluent for extended periods can become equilibrated to the increased partial pressures of gases within the effluent. If these organisms are subsequently exposed to water with lower partial pressures (which occurs when the water cools or when the organisms move to water in other locations or at other depths), dissolved gas (especially nitrogen) within the tissues may come out of solution and form embolisms (bubbles) within the affected tissues, most noticeably the eyes and fins. The resulting condition is known as gas bubble disease.

In the 2013 GEIS, the NRC concluded that there would be no change in effects of low dissolved oxygen concentrations or gas supersaturation on aquatic biota during the license renewal term in the absence of changes to operation of the cooling system or the ambient conditions. Overall, the NRC concluded that impacts of plant operation on low dissolved oxygen concentrations and gas supersaturation attributable to cooling water discharges would be SMALL for all plants.

For initial license renewals, the NRC codified its conclusion that effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication are expected to be SMALL under normal operating conditions. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been mitigated. Low dissolved oxygen was a concern at one nuclear power plant with a once-through cooling system but has been mitigated. Eutrophication (nutrient loading) and resulting effects on chemical and biological oxygen demands have not been found to be a problem at operating nuclear power plants.

4.6.14.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on effects of cooling water discharge on dissolved oxygen, gas supersaturation and eutrophication since initial license renewal. Temperature and dissolved oxygen studies are discussed in the ONS SLR ER Section 3.7.1.1. Thermal and water quality studies on Lake Keowee have been done to assess temporal and spatial patterns and to identify factors that influence these patterns. Several sites around the lake are used to monitor surface water temperatures. On average surface water temperatures range from 11.3–32.6° Celsius (C). Temperatures nearest the heated water discharge are expectedly higher ranging from 14.1–34.9°C, whereas water temperatures farthest from the discharge range from 8–31.8°C. Dissolved oxygen (DO) concentrations across the lake are typically similar, with only the discharge location generally being slightly less. The minimum surface DO value recorded for the lake as a whole over the last 6-year period was 5.6 mg/L, which exceeds the state water quality standards. Lake Keowee water surface temperatures and DO are similar to other comparable southeastern reservoirs. (Duke 2021a)

Studies were also conducted from 2012–2019 to determine the effects of ONS's thermal discharge on the aquatic biological community of Lake Keowee. During this time, overall water temperatures and dissolved oxygen levels were within historical ranges and remained at levels that could support a warmwater fish community, similar to other South Carolina piedmont reservoirs. (Duke 2021a)

Thermal and water quality studies on Lake Keowee also encompass monthly chlorophyll a, and quarterly phytoplankton standing crop monitoring. Phytoplankton chlorophyll a and standing crop data showed minimal variations and relatively low concentrations during 2006-2011. No deleterious impacts from thermal inputs were observed in the phytoplankton community in Lake Keowee. No large populations of thermally tolerant species or nuisance algae were observed, and

no algae blooms have ever been recorded from Lake Keowee over the period of historical sampling. Lake Keowee was found to support small but highly diverse and viable phytoplankton communities throughout 2006–2011. Continued monitoring of phytoplankton and zooplankton communities at the ONS site have not detected any changes in Lake Keowee that would alter the conclusions drawn since the submittal of the last permit renewal application in 2013. Studies conducted between 2012 and 2019 indicated that Lake Keowee continued to support highly variable and diverse phytoplankton communities, and no obvious short-term or long-term impacts of station operations were observed. The studies further concluded that Lake Keowee continued to support a highly diverse zooplankton community, and no discernible impacts of plant operations had been observed. (Duke 2021a)

No change in the operation of the cooling system is expected during the proposed license renewal term so no change in effects on DO, gas supersaturation, and eutrophication are anticipated.

Duke Energy finds that the effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication for the proposed SPEO term would be SMALL.

EFFECTS ON NON-RADIOLOGICAL CONTAMINANTS ON AQUATIC ORGANISMS

Affected SLRA Sections:

New ER Section 4.6.15, Effects of Non-Radiological Contaminants on Aquatic Organisms

4.6.15.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

The NRC considered the potential for non-radiological contaminants to accumulate in sediments or aquatic biota in the 2013 GEIS. This was originally raised as an issue of concern at a few power plants that used copper alloy condenser tubes, but this concern has been successfully mitigated by replacing copper alloy tubes with those made from other metals (e.g., titanium). An operating nuclear power plant can contribute other contaminants by concentrating existing constituents from the water body (e.g., in blowdown at closed-cycle plants) or by the addition of chemicals to cooling water during plant operations (e.g., biocides). Concentrations of heavy metals and other contaminants in the discharges of nuclear power plants are normally quickly diluted or flushed from the area by the large volumes of the receiving water. The discharge of metals and other toxic contaminants may also be subject to controls implemented by state or federal agencies through the NPDES permit process. Impacts of contaminant discharges are considered to be of SMALL significance if water quality criteria (e.g., NPDES permits) are not violated and if aquatic organisms in the vicinity of the plant are not bioaccumulating the contaminants.

For initial license renewals, the NRC codified its conclusion that effects of non-radiological contaminants on aquatic organisms are expected to be SMALL assuming no local bioaccumulations and operating under permitted conditions at nuclear power plants. Best management practices and discharge limitations of NPDES permits are expected to minimize the potential for impacts to aquatic resources during continued operations and refurbishment associated with license renewal. Accumulation of metal contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal.

4.6.15.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on effects of non-radiological contaminants on aquatic organisms since initial license renewal. There is not a metals discharge concern for ONS's CCW discharge, as discussed in ER Section 4.5.10. Condenser cleaning is by mechanical means to reduce and prevent fouling of the condenser tubes by circulating sponge balls through the tubes and thus cleaning tubes while the plant is in

operation. ONS connected to a municipal sewage treatment system in 2010 and no longer discharges sanitary wastewater (Duke 2021a).

The discharge of water treatment chemicals and other contaminates in discharges is discussed in detail in ER Section 4.5.11. The addition of biocides is governed by ONS's NPDES permit (ONS SLRA Attachment B). The NPDES permit also addresses the use of other additives and water treatment chemicals. The SCDHEC established NPDES permit limits and monitoring requirements, including biological chronic toxicity testing for discharges after conducting reasonable potential analysis based on data reported in Duke Energy's application. SCDHEC requires data on the presence and concentration of an extensive list of contaminates (Duke 2021a).

Sumps within ONS structures and yard drains capture spills. Yard drains also capture stormwater runoff in operational areas. These drains are routed to ONS's wastewater treatment system for industrial wastewater that involves three chemical treatment ponds (CTPs). These ponds are permitted under the NPDES permit and discharge through Outfall 002. The NPDES permit sets limits and monitoring requirements for Outfall 002. (Duke 2021a)

As presented in the ONS SLR ER Section 3.5.3.2, Duke Energy complies with stormwater regulations, obtains necessary stormwater permits, develops SWPPPs, and implements BMPs. (Duke 2021a)

There are no plant operations or modifications planned for the proposed SPEO term that would alter discharge patterns. Compliance with regulatory, permit, and license requirements would ensure that impacts of non-radiological contaminants continue to be SMALL at ONS during the SPEO term.

Duke Energy finds that the effects of non-radiological contaminants on aquatic organisms for the proposed SPEO term would be SMALL.

EXPOSURE OF AQUATIC ORGANISMS TO RADIONUCLIDES

Affected SLRA Sections:

New ER Section 4.6.16, Exposure of Aquatic Organisms to Radionuclides

4.6.16.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

Pathways for aquatic biota exposure considered by the NRC in the 2013 GEIS included that aquatic biota can be exposed externally to ionizing radiation from radionuclides in water, sediment, and other biota, and aquatic biota can be exposed internally via ingested food and water and, in certain situations, absorption through the skin and respiratory organs. No evidence of significant differences in sensitivity to radionuclides between marine and freshwater organisms has been reported. Some radionuclides tend to follow pathways similar to their nutrient analogs and can therefore be transferred rapidly through the food chain. These include (1) radionuclides such as strontium-90, barium-140, radon-226, and calcium-46 that behave like calcium and are therefore accumulated in bony tissues; (2) radionuclides such as iodine-129 and iodine-131 that act like stable iodine and accumulate in thyroid tissue; (3) radionuclides such as potassium-40, cesium 137, and rubidium-86 that follow the general movement of potassium and can be distributed throughout the body; and (4) radionuclides such as tritium, which resembles stable hydrogen, that is distributed throughout the body of an organism.

In the 2013 GEIS, the NRC conducted a review of all operating nuclear power plants to evaluate the potential impacts of radionuclides on aquatic biota from continued operations. The NRC selected 15 representative plants to calculate estimated dose rates for aquatic biota. The total estimated dose rates for aquatic biota for these plants were all less than 0.2 rad/d (0.002 Gy/d), considerably less than the U.S. Department of Energy's (DOE) guideline value of 1 rad/d (0.01 Gy/d) for aquatic biota. On the basis of the reviewed literature and the dose rates estimated for aquatic biota from site-specific data, the NRC concluded that the impact of radionuclides on aquatic biota from past operations would be SMALL for all plants.

For initial license renewals, the NRC codified its conclusion that impacts of exposure of aquatic organisms to radionuclides are expected to be SMALL from routine radionuclide releases. Doses to aquatic organisms are expected to be well below exposure guidelines developed to protect these aquatic organisms.

4.6.16.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on exposure of aquatic organisms to radionuclides since initial license renewal. ONS operates in

accordance with its NRC operating license. Releases are maintained in compliance with 10 CFR Part 20 limits and reported in annual radioactive effluent release reports submitted to the NRC. In addition, as stated in ONS SLR ER Section 3.10.3, ONS conducts routine periodic sampling in accordance with its REMP. Duke Energy monitors radioactivity levels by collecting samples of air, drinking water, surface water, shoreline sediment, fish, milk, and broadleaf vegetation, and collects direct radiation exposure using thermoluminescent dosimetry (TLD) at various sampling locations (Duke 2021a).

As discussed in Section 4.6.7, Duke Energy prepares an annual radiological environmental operating report (AREOR) for ONS for submittal to NRC. The results for 2020 were within the ranges of radioactivity concentrations observed in the past. Radioactivity concentrations in drinking water, surface water, fish, and shoreline sediment attributable to station operation were within selected licensee commitment levels which are selected for evaluation and trending. Further, environmental radiological monitoring data is consistent with effluents introduced into the environment by plant operations. From the review of these results presented in ONS SLR ER Section 3.10.3, Duke Energy concluded that the continued operation of ONS has not contributed measurable radiation or the presence of gamma radioactivity in the environmental media monitored. The surface water and drinking water samples revealed tritium concentrations that are well within the applicable regulatory limits. The radiological environmental data for 2020 indicates that radioactivity concentrations were not higher than expected, and all positively identified measurements attributable to ONS operations in 2020 were within limits as specified in the ONS ODCM; thus, presenting no significant impact on the environment or public safety. (Duke 2021a; Duke 2021b)

Continued compliance with NRC radiological effluent limits and implementation of the REMP will ensure that aquatic organisms' exposure to radionuclides is well within guidelines and adverse trends are detected in order to implement corrective actions.

Duke Energy finds that impacts of exposure of aquatic organisms to radionuclides for the proposed SPEO term would be SMALL.

EFFECTS OF DREDGING ON AQUATIC ORGANISMS

Affected SLRA Sections:

New ER Section 4.6.17, Effects of Dredging on Aquatic Organisms

4.6.17.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

Dredging is an activity that is performed at some power plants to remove accumulated sediments from intake and discharge areas (or, more rarely, to maintain barge slips) and may have localized impacts on aquatic biota. In the 2013 GEIS, the NRC considered the potential impacts to aquatic organisms from dredging operations to support nuclear power plant operations and anticipated that maintenance dredging would occur infrequently, would be of relatively short duration, would affect relatively small areas, and would be primarily undertaken in areas containing soft sediments that would be recolonized fairly rapidly by benthic organisms in surrounding areas. NRC also considered that the levels of chemical and radionuclide contamination of sediments in the areas near power plant intakes and discharges that would need to be dredged are likely to be relatively low. The NRC considered compliance with USACE, and applicable state permits sufficient to mitigate any impacts to a SMALL significance.

For initial license renewals, the NRC codified its conclusion that effects of dredging on aquatic organisms are expected to be SMALL. Dredging at nuclear power plants is expected to occur infrequently, would be of relatively short duration, and would affect relatively small areas. Dredging is performed under permit from the USACE, and possibly, from other state or local agencies.

4.6.17.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on effects of dredging on aquatic organisms since initial license renewal. ONS does not periodically dredge at Lake Keowee and does not anticipate dredging during the proposed SPEO term. However, should any dredging needs arise for plant operations at ONS, Duke Energy would obtain the necessary federal and state permits. Compliance with regulatory requirements and permit conditions will ensure continued SMALL impact from discharges.

Duke Energy finds that effects of dredging on aquatic organisms for the proposed SPEO term would be SMALL.

EFFECTS ON AQUATIC RESOURCES (NON-COOLING SYSTEM IMPACTS)

Affected SLRA Sections:

New ER Section 4.6.18, Effects on Aquatic Resources (Non-Cooling System Impacts)

4.6.18.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

Impacts on aquatic resources from continued operations and refurbishment activities could occur at all operating nuclear power plants during the license renewal term as a result of (1) direct disturbance (e.g., ground disturbance, draining ponds, blocking or redirecting streams, and placing riprap along shorelines) of aquatic habitats within project areas; (2) sedimentation of nearby aquatic habitats as a consequence of soil erosion; (3) changes in water quantity or water quality (e.g., grading that affects surface runoff patterns or depletions or discharges of water into aquatic habitats); or (4) releases of chemical contaminants into nearby aquatic systems. In the 2013 license renewal GEIS, the NRC reviewed these activities and their effects under this issue as listed above, with the understanding that permits from various federal, state, and local governmental authorities are typically required for ground-disturbing activities and with proper application of environmental reviews, permitting processes, and BMPs, impacts on sensitive aquatic habitats would likely be avoided. With this understanding, the NRC concluded that the impact of continued operations and refurbishment activities on aquatic resources would be SMALL.

For initial license renewals, the NRC codified its conclusion that effects on aquatic resources (non-cooling system impacts) are expected to be SMALL under normal operating and permitted conditions at nuclear power plants. Licensee application of appropriate mitigation measures is expected to result in no more than small changes to aquatic communities from their current condition.

4.6.18.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information for effects on aquatic resources (non-cooling system impacts) since initial license renewal. ONS has procedures and plans in place to address concern for the potential for impacts to onsite and nearby aquatic habitats as a consequence of site disturbance, soil erosion, changes in water quality, or releases of chemical contaminants as detailed below. ONS has administrative procedures that establish the policies and general requirements for ongoing operations, maintenance, and construction activities to be conducted in accordance with applicable federal, state, and local regulations and permit conditions.

ONS has not proposed any refurbishment activities or construction of new facilities related to SPEO term. ONS's wastewater and stormwater discharges are governed by NPDES permits. Development and/or construction activities along the Lake Keowee shoreline is controlled by the Shoreline Management Plan for the Keowee-Toxaway project (Duke 2014).

ONS has a SWPPP, an SPCC plan, a spill response procedure, and a ground disturbance procedure in place to address concern for the potential for impacts to onsite and nearby aquatic habitats as a consequence of site disturbance, soil erosion, changes in water quality, or releases of chemical contaminants as detailed below.

As discussed under the ONS SLR ER 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 appropriate permits be obtained and soil and erosion plans be developed prior to land disturbance. In addition, any ground disturbance of one or more acres requires a construction stormwater permit to be obtained from the SCDHEC. The construction stormwater permit specifies BMPs to reduce erosion caused by stormwater runoff, thereby minimizing the risk of pollution from soil erosion and sediment, and potentially from other pollutants that the stormwater may contact. (Duke 2021a)

As discussed in ONS SLR ER Section 9.5.3.5, ONS also has a 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. ONS has a spill response procedure requiring all staff to promptly notify and respond to a spill. The procedure also provides a process for investigation and corrective action. (Duke 2021a) ONS also has a chemical control program for managing storage areas and assessing and mitigating risk from hazardous and toxic chemicals.

Based on review of site records for spill notification and environmental compliance from January 2014–September 2022, four spills were recorded; two spills were reported to the National Response Center, and two reported to the SCDHEC. The first two 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 approximately 4 ounces of hydraulic oil while testing a submersible hydraulic pump adjacent to the Keowee Hydro Station spillway on February 8, 2018. A third spill occurred on November 1, 2021 and involved the spraying of approximately 3-5 gallons of untreated clear water from a sewage air ejector into the Unit 1&2 Turbine Building Sump due to a crack in the PVC pipe. The spill was contained, and no additional actions were required and was closed by SCDHEC on November 4, 2021. A fourth spill occurred on August 15, 2022, when both sewage air ejectors for the Maintenance Support Building failed, causing a sewage spill of approximately 50 gallons into the Keowee River. All appropriate notifications were made, with

written notification to SCDHEC via ePermitting (SCDHEC) website, as well as a courtesy call to SCDHEC Anderson Regional DEQ. The sewage air ejectors were repaired, and additional mitigating actions were completed (Duke 2021a). In summary, for all the four spills mentioned above, all necessary mitigative/reparative actions were performed in a timely manner, and ONS worked closely with the corresponding regulatory agencies to report and alleviate any outcomes from these spills. Hence, given the relatively minor size of the spills and timely interventions by ONS staff, there are no ongoing impacts, and these four items are closed.

There are no refurbishment or construction activities planned for the proposed SPEO term. Compliance with current and future NPDES regulatory requirements and permit conditions, and implementation of the SWPPP, BMPs, SPCC, and the ground disturbance procedure will continue to minimize the potential for impacts of direct disturbance, sedimentation, water quality changes or contamination on aquatic resources.

Duke Energy finds that effects on aquatic resources (non-cooling system impacts) for the proposed SPEO term would be SMALL.

IMPACTS OF TRANSMISSION LINE RIGHT-OF-WAY MANAGEMENT ON AQUATIC RESOURCES

Affected SLRA Sections:

New ER Section 4.6.19, Impacts of Transmission Line Right-of-Way Management on Aquatic Resources

4.6.19.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

Continued operations and refurbishment activities will require management and maintenance of in-scope transmission lines and associated in-scope transmission line ROWs. This could result in negative impacts on aquatic resources within the ROW or from runoff associated with in-scope transmission line management and maintenance. In the 2013 license renewal GEIS, the NRC considered the impacts of transmission line ROW management on aquatic species and found that changes in aquatic species diversity, abundance, or health from transmission line ROW maintenance are likely to be SMALL. The continued use of proper management practices with respect to soil erosion and application of herbicides is expected. In addition, license renewal for a specific plant would affect only the portion of the transmission line that connects the power plant to the first substation, so the amount of aquatic habitat crossed is likely to be SMALL.

For initial license renewals, the NRC codified its conclusion that impacts of transmission line right-of-way management on aquatic resources are expected to be SMALL. Licensee application of best management practices to ROW maintenance is expected to result in no more than small impacts to aquatic resources.

4.6.19.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on impacts of transmission line right-of-way management on aquatic resources since initial license renewal. The in-scope transmission lines are discussed in the ONS SLR ER Section 2.2.5.1 and depicted in ONS SLR ER Figure 2.2-4. The lines are confined to the ONS site, in a developed area of the site, traverse a short distance between the plant and switchyards, and do not cross waterbodies. (Duke 2021a) The short distances of in-scope transmission lines indicate this issue would not be considered significant for ONS.

The regulatory programs that the ONS site is currently subject to, such as stormwater management, spill prevention, and herbicide usage, further minimize impacts to terrestrial resources. ONS has administrative policies and implements BMPs for preventing erosion from soil

disruption. The NPDES permit requires ONS to implement BMPs to protect surface water and groundwater from runoff of pollutants and loose soil in industrial areas.

Continued in-scope transmission line ROW management will maintain aquatic communities and resources in their current condition. Implementation of BMPs and adherence to vegetation management protocols will ensure minimal impact on aquatic resources from ROW management and maintenance.

Duke Energy finds that impacts of transmission line right-of-way management on aquatic resources for the proposed SPEO term would be SMALL.

LOSSES FROM PREDATION, PARASITISM, AND DISEASE AMONG ORGANISMS EXPOSED TO SUB-LETHAL STRESSES

Affected SLRA Sections:

New ER Section 4.6.20, Losses from Predation, Parasitism, and Disease Among Organisms Exposed to Sub-Lethal Stresses

4.6.20.1 Generic Analysis for Initial License Renewal [GEIS Section 4.6.1.2]

The NRC reviewed the potential for adverse impacts due to losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses in the 2013 GEIS for license renewal. During the license renewal term, cooling system intake and discharge would continue to affect aquatic resources. Sub-lethal stresses can come from impingement, entrainment, thermal discharge, low dissolved oxygen levels, gas supersaturation in tissues, and exposure to radionuclides and non-radiological contaminants. Impacts such as increased susceptibility to predation, parasitism, and disease can increase for species exposed to sub-lethal stresses. The effects of low dissolved oxygen levels are not expected to be felt by aquatic species beyond the thermal mixing zone. It is anticipated that heavy metal concentrations and radionuclide releases related to normal plant operations would not result in negative effects on aquatic biota. Impacts on the susceptibility of aquatic organisms to predation, parasitism, and disease due to sub-lethal stresses are considered to be of SMALL significance if changes are localized and populations of aquatic organisms in the receiving water body are not reduced. Indirect power plant-induced mortality has not been shown to cause reductions in the overall populations of aquatic organisms near any existing nuclear power plants. The level of impact due to sub-lethal stresses has been SMALL at plants reviewed by the NRC in the 2013 GEIS and is expected to be SMALL for all nuclear plants.

For initial license renewals, the NRC codified its conclusion that impacts of losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses are expected to be SMALL assuming localized changes and relatively stable populations of aquatic organisms in the vicinity of operating nuclear power plants.

4.6.20.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on losses from predation, parasitism, and disease among organisms exposed to sub lethal stresses since initial license renewal. For ONS, the stresses of impingement, entrainment, thermal discharge, low-dissolved oxygen levels, gas supersaturation in tissues, and exposure to radionuclides and non-radiological contaminants are discussed in detail under other issues and summarized below:

- Surface water use and quality (non-cooling system impacts): Compliance with current and future NPDES and stormwater regulatory requirements and permit conditions, and implementation of SWPPP, BMPs, and the SPCC plan will ensure a SMALL impact on surface water quality from non-cooling systems during the proposed SPEO term. Compliance with water use permits and regulations would ensure a SMALL impact on surface water use.

- Altered current patterns at intake and discharge structures: Lake Keowee serves as the waterbody source for ONS's cooling system. The impoundment delays the flow of Keowee River, and the Little River and the volume of the impoundment is controlled by the Keowee Hydro Station located at Keowee Dam. Based on the size of Lake Keowee and the fact that there are no modifications planned that would alter the existing current pattern, impacts to surface water use and quality are SMALL.

- Discharge of metals in cooling system effluent: ONS's NPDES permit does not have metals limits or require monitoring for metals for Outfall 001, the circulating condenser cooling water outfall. The SCDHEC reviewed the need for a metal limit in the permit, using 5 years' worth of metal concentration data in the lake at the intake and outfall. Based on this review, SCDHEC concluded that there was no reasonable potential to cause or contribute to a water quality violation. SCDHEC also ran a reasonable potential analysis on all other data reported in Duke Energy's application section 2C which requires data on the presence and concentration of various metals and concluded that there was no reasonable potential for any other parameters to cause or contribute to a water quality discharge violation (Duke 2021a, Attachment B).

- Discharge of biocides, sanitary wastes, and minor chemical spills: As discussed in ONS SLR ER Section 9.5.3.5, the NPDES permit addresses the use of biocides and other additives and water treatment chemicals. (Duke 2021a). Condenser cleaning is by mechanical means to reduce and prevent fouling of the condenser tubes. ONS connected to a municipal sewage treatment system in 2010 and no longer discharges sanitary wastewater (Duke 2021a). Sumps within the ONS premises capture spills that are then routed to ONS's wastewater treatment system. ONS also has a SPCC to minimize the frequency and severity of spills (Duke 2021a), and a chemical control program for mitigating risks from toxic chemicals. There are no proposed changes to the discharge of biocides, wastes and spills, and continued compliance with current and future NPDES regulatory requirements and permit conditions will ensure the impact of biocides and minor chemical spills to be SMALL.

- Temperature effects on sediment transport capacity: ONS discharges heated cooling water at a depth of approximately 20 feet. The discharge temperature is governed by the

NPDES permit; ONS operates in compliance with the permit. No change in the operation of the cooling system is expected during the proposed SPEO term; therefore, no change in effects on sediment transport capacity is anticipated.

- Entrainment of phytoplankton and zooplankton: Duke Energy complies with the current NPDES permit and will comply with future renewal of the permit, implementing any best technology available requirements determined necessary to minimize impacts of impingement and entrainment. Further, previous sampling and analysis indicates that operation of ONS is not having a negative impact on the aquatic community of Lake Keowee. With continued compliance with NPDES requirements, impacts from impingement and entrainment of aquatic organisms during the proposed SPEO operating term would be SMALL.

- Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication: Periodic thermal and water quality studies on Lake Keowee have been conducted to assess temporal and spatial patterns and to identify factors that influence these patterns. DO concentrations across the lake are typically similar, with only the discharge location generally being slightly less. Lake Keowee water surface temperatures and DO are similar to other comparable southeastern reservoirs, and further, studies have not shown any major long-term decreases in overall fish abundance and species diversity in Lake Keowee. No change in the operation of the cooling system is expected during the proposed SPEO term, so effects of cooling water discharge on DO, gas supersaturation, and eutrophication are anticipated to be SMALL.

- Effects of non-radiological contaminants on aquatic organisms: There is not a metals discharge concern for ONS's CCW discharge as discussed in the above bullet related to altered current patterns at intake and discharge structures. The SCDHEC established NPDES permit limits and monitoring requirements, including biological chronic toxicity testing for discharges. Since no alterations are planned for the proposed SPEO term and discharges would continue to be in compliance with the NPDES permit, effects of non-radiological contaminants on aquatic organisms will be SMALL.

- Exposure of aquatic organisms to radionuclides: ONS operates in accordance with its license. Releases are maintained in compliance with 10 CFR Part 20 limits and reported in annual radioactive effluent release reports submitted to the NRC. In addition, ONS conducts routine periodic sampling in accordance with its REMP. Duke Energy concluded that station operations have no significant radiological impact on the health and safety of the public or the environment. Hence the impact of exposure of aquatic organisms to radionuclides during the SPEO term will continue to be SMALL.

- Effects on aquatic resources (non-cooling system impacts): ONS's wastewater and stormwater discharges are governed by NPDES permits; ONS has a SWPPP, an SPCC plan, a spill response procedure, and a ground disturbance procedure. There are no refurbishment or construction activities planned for the proposed SPEO term. Compliance with current and future NPDES regulatory requirements and permit conditions, and implementation of the SWPPP, BMPs, SPCC, and the ground disturbance procedure will continue to minimize the potential for impacts on aquatic resources.

Consideration of the above issues would indicate sub-lethal stresses are not significantly impacting the aquatic resources in the vicinity of ONS. As such, losses from predation, parasitism, and disease among organism exposed to sub-lethal stresses during the SPEO term would be SMALL.

Duke Energy finds that impacts of losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses for the proposed SPEO term would be SMALL.

EMPLOYMENT AND INCOME, RECREATION, AND TOURISM

Affected SLRA Sections:

ER Section 4.8.1, Employment and Income, Recreation and Tourism

4.8.1.1 Generic Analysis for Initial License Renewal [GEIS Section 4.8.1.1]

In the 2013 license renewal GEIS, the NRC reviewed the employment, income, recreation and tourism impacts of continued operation and refurbishment on visual resources and notes that the nuclear power plant and the communities that support it is a dynamic socioeconomic system. The communities provide the people, goods, and services required to operate the facility and, in turn, the plant provides employment and income to the communities. The potential to negatively affect employment and income in surrounding communities is tied to changes in anticipated employment at the nuclear power plants. In its review, the NRC found that employment levels at a nuclear power plant, either through continued operation or refurbishment activities, are not anticipated to change as a result of license renewal. The NRC also evaluated potential negative effects on visual resources, which could impact recreation and tourism. In its review, NRC staff found that existing visual profiles of nuclear power plants were not expected to change during the license renewal term (see Section 4.1.3.1). Consequently, tourism and recreational activities in the vicinity of nuclear plants are not expected to change as a result of subsequent license renewal.

For initial license renewals, the NRC codified its conclusion that the impact of continued nuclear plant operations and refurbishment activities on employment, income, recreation and tourism would be SMALL. Although most nuclear plants have large numbers of employees with higher-than-average wages and salaries, employment income, recreation, and tourism impacts from continued operations and refurbishment associated with license renewal are expected to be small.

4.8.1.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on employment and income, recreation, and tourism since initial license renewal. Information related to employment and income, and recreational facilities is discussed in ONS SLR ER Sections 3.9.1 and 3.9.7. In addition, as presented in ONS SLR ER Section 2.5, there are no plans to add regular full-time employees to support plant operations during the proposed SPEO 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 subsequent license renewal-related refurbishment activities have been identified, as presented in ONS SLR ER Section 2.3. (Duke 2021a) Therefore, no changes in employment and income, and recreation and tourism during the proposed SPEO term are anticipated.

Because there are no anticipated changes to the operational workforce or the site's visual profile during the SPEO term, and no refurbishment is planned, the people living in the vicinity of ONS are not likely to experience any changes in socioeconomic or aesthetic conditions during the proposed SPEO term.

Duke Energy finds that impacts to employment and income, recreation, and tourism for the proposed SPEO term would be SMALL.

TAX REVENUES

Affected SLRA Sections:

ER Section 4.8.2, Tax Revenues

4.8.2.1 Generic Analysis for Initial License Renewal [GEIS Section 4.8.1.2]

In the 2013 license renewal GEIS, the NRC reviewed socioeconomic impacts of continued operation and refurbishment resulting from tax payments associated with nuclear power plants. 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 surrounding 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.

For initial license renewals, the NRC codified its conclusion that the impact of continued nuclear plant operations and refurbishment on tax revenue would be 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 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on tax revenues since initial license renewal. Information related to annual property tax payments made on behalf of ONS for the years 2015-2019 is presented in ONS SLR ER Section 3.9.5. Tax payments for the years 2020 and 2021, along with 2020 property tax adjustments, can be found herein, in Tables 4.8-1 and 4.8-2, respectively. As discussed in ONS SLR ER Section 3.9.5, Duke Energy's tax payment to Oconee County for FY 2020 was lower than other years due to a refund after appeal to the State of South Carolina (Duke 2021a).

As discussed in ONS SLR ER Section 2.3, no subsequent license renewal-related refurbishment activities have been identified (Duke 2021a). Duke Energy plans to continue to operate ONS as currently designed, and no associated changes to plant employment or ONS taxable property value is anticipated. Duke Energy's annual property taxes are expected to remain relatively constant throughout the SPEO with no notable future increases or decreases.

Because there are no anticipated changes to the operational workforce, no refurbishment is planned, and tax payments are expected to remain constant with no notable future increases or decreases, the people living in the ONS region are not likely to experience any changes in socioeconomic conditions during the proposed SPEO term.

Duke Energy finds that impacts to tax revenues for the proposed SPEO term would be SMALL.

Table 4.8-1 Property Tax Payments to Oconee County, 2020-2022

FY	Property Tax Paid by Duke Energy	FY Total County Property Tax Revenues	Duke Energy % of Total County Property Tax	FY Duke Energy Payment Appropriated to School District
2020	$25.7 million	$46,988,832	54.7	$18 million
2021	$32.9 million	$49,241,399	66.8	$22.6 million
2022	NYA	NYA	NYA	NYA

FY = Fiscal Year
NYA = Not Yet Available
(OC 2020; OC 2021)

Table 4.8-2 Property Tax Adjustments to Oconee County

FY	Property Tax Adjustment Amount	Reason
2020	($6.4 million) [a]	Appeal
2020	$4 million [b]	Appeal

NYA - Not Yet Available
FY = Fiscal Year
a. Amount refunded after appeal to the State of South Carolina, January 2020.
b. Appeals payment, June 2020. Payment is not reflected in 2020 CAFR.

COMMUNITY SERVICES AND EDUCATION

Affected SLRA Sections:

ER Section 4.8.3, Community Services and Education

4.8.3.1 Generic Analysis for Initial License Renewal [GEIS Section 4.8.1.3]

In the 2013 license renewal GEIS, the NRC reviewed the impacts of continued operation and refurbishment on community services and education. 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.

For initial license renewals, the NRC codified its conclusion that the impact of continued nuclear plant operations and refurbishment activities on community services and education would be 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 PILOT payments expected during the license renewal term, community and educational services would not be affected by continued power plant operations.

4.8.3.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on community services and education since initial license renewal. Information related to community services and education is discussed in ONS SLR ER Section 3.9.4. No subsequent license renewal-related refurbishment activities have been identified, as presented in ONS SLR ER Section 2.3. In addition, as presented in ONS SLR ER Section 2.5, there are no plans to add regular full-time employees to support plant operations during the proposed SPEO term. (Duke 2021a) As stated above in Section 4.8.2, Duke Energy's annual property taxes are expected to remain relatively constant throughout the proposed SPEO, and no change is anticipated that would impact local community services and education.

Because no changes to employment are expected from continued operations, tax payments are anticipated to remain consistent throughout the SPEO term, and no refurbishment activities are planned, the people living in the vicinity of ONS are not likely to experience any changes in socioeconomic conditions during the proposed SPEO term beyond the current conditions.

Duke Energy finds that impacts to community services and education for the proposed SPEO term would be SMALL.

POPULATION AND HOUSING

Affected SLRA Sections:

ER Section 4.8.4, Population and Housing

4.8.4.1 Generic Analysis for Initial License Renewal [GEIS Section 4.8.1.4]

In the 2013 license renewal GEIS, the NRC reviewed the impacts of continued operation and refurbishment on population and housing. 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.

For initial license renewals, the NRC codified its conclusion that the impact of continued nuclear plant operations and refurbishment activities on population and housing would be 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 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on population and housing since initial license renewal. Information related to population and housing is discussed in ONS SLR ER Section 3.9.2. No subsequent license renewal-related refurbishment

activities have been identified, as presented in ONS SLR ER Section 2.3. As presented in ONS SLR ER Section 2.5, there are no plans to add regular full-time employees to support plant operations during the SPEO. (Duke 2021a)

Because no changes to employment are expected and no refurbishment activities are planned that would require additional workers, the people living in the vicinity of ONS are not likely to experience any changes in population and housing conditions during the proposed SPEO term.

Duke Energy finds that impacts to population and housing for the proposed SPEO term would be SMALL.

TRANSPORTATION

Affected SLRA Sections:

ER Section 4.8.5, Transportation

4.8.5.1 Generic Analysis for Initial License Renewal [GEIS Section 4.8.1.5]

In the 2013 license renewal GEIS, the NRC reviewed the impacts of continued operation and refurbishment on transportation. 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.

For initial license renewals, the NRC codified its conclusion that the impact of continued operations and refurbishment activities on local transportation would be SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to traffic volumes would be small.

4.8.5.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on transportation since initial license renewal. Information related to transportation is discussed in ONS SLR ER Section 3.9.6. No subsequent license renewal-related refurbishment activities have been identified, as presented in ONS SLR ER Section 2.3. As presented in ONS SLR ER Section 2.5, there are no plans to add regular full-time employees to support plant operations during the SPEO. In addition, as discussed in ONS SLR ER Section 3.9.6, roads with plant access in the immediate vicinity of ONS will continue to operate at acceptable LOS levels. (Duke 2021a)

Because no changes to employment are expected and no refurbishment activities are planned that would require additional workers, the people living in the vicinity of ONS are not likely to experience any changes in transportation conditions associated with ONS during the proposed SPEO term.

Duke Energy finds that impacts to transportation for the proposed SPEO term would be SMALL.

RADIATION EXPOSURES TO THE PUBLIC

Affected SLRA Sections:

New ER Section 4.9.3, Radiation Exposures to the Public

4.9.3.1 Generic Analysis for Initial License Renewal [GEIS Section 4.9.1.1.3]

NRC regulations in 10 CFR Part 20 identify maximum allowable concentrations of radionuclides that can be released from a licensed facility to control radiation exposures of the public. In addition, pursuant to 10 CFR 50.36a, nuclear power reactors have special license conditions requiring minimization of radiological impacts associated with plant operations to “as low as reasonably achievable” (ALARA) levels. Nuclear power plant releases to the environment must also comply with EPA standards in 40 CFR Part 190. These standards specify limits on the annual dose equivalent from normal operations of uranium fuel-cycle facilities.

In the 2013 license renewal GEIS, the NRC reviewed industry-wide data on radioactive releases from nuclear power operations. NRC concluded based on this body of data and its oversight experience that for normal operations radioactivity releases would continue during a PEO similar to that of current operations (i.e., the first 40 years of operation). The NRC also reviewed radiation exposures to the public in the 2013 GEIS and concluded that experience with the design, construction, and operation of nuclear power reactors indicate that compliance with the design objectives of Appendix I to 10 CFR Part 50 will keep average annual releases of radioactive material in effluents at small percentages of the limits specified in 10 CFR Part 20 and 40 CFR Part 190. NRC also concluded that no aspect of future operation has been identified that would substantially alter this situation.

In the GEIS, NRC also considered cumulative dose from an additional 20 years of operation, acknowledging the fatal cancer risk from the cumulative dose to the hypothetical Maximumly Exposed Individual (MEI) would be 50 percent higher for 60 years of operation over the baseline of 40 years of operation.

NRC’s GEIS analysis of decommissioning impacts addresses the accumulation of long-lived radionuclides from an additional 20 years of operation in an initial license renewal concluded that the increase would result in a negligible dose (less than 0.1 person-rem). (NRC 2013a, pg. 4-217)

For initial license renewals, the NRC codified its conclusion that radiation doses to the public from continued operations and refurbishment associated with license renewal would be SMALL. NRC concluded that radiation exposures to the public are expected to continue at current levels and would be well below regulatory limits.

4.9.3.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on radiation exposures to the public since initial license renewal. The proposed action is to continue to operate as currently designed; no refurbishment activities are proposed, so radioactive effluents would be similar to current operations. ONS submits annual radioactive effluent release reports to NRC and calculates the public dose from its liquid and gaseous radioactive releases. ONS uses its offsite dose calculation manual, updated as needed, to provide methods and parameters for calculating offsite doses in accordance with NRC requirements. These methods ensure that radioactive discharges from ONS meet NRC and EPA regulatory dose standards. As presented in ONS SLR ER Section 3.10.3, the annual public dose was in accordance with radiation protection standards for years 2014–2019 (Duke 2021a). The reports for years 2020 and 2021 indicate that the public dose from the radioactive effluents were a fraction of regulatory limits (Duke 2021c; Duke 2022a). Because there is no reason to expect effluents to increase in the SPEO, annual doses to the public from continued operation are expected to be within regulatory limits.

As discussed above, ONS's annual releases are a fraction of regulatory limits. The maximum MEI dose from 2021 operations was calculated to be 0.280 mrem for total body (Duke 2022a). The ALARA annual offsite dose objective is 3 mrem to the whole body for the MEI, according to Appendix I to 10 CFR 50. This ALARA objective is 3 percent of the annual public radiation dose limit of 100 mrem and a small fraction of the natural background radiation dose. Using the 2021 result, 20-years of operation would cumulatively expose this MEI to 5.6 percent of the annual public radiation dose limit. At ONS, the maximum exposed member of the public (the MEI) is a child one mile SW of the plant (Duke 2022a). This MEI would be unlikely to have exposure duration of 40-years, with 60 and 80 years even more unlikely. NRC likewise acknowledged the unlikelihood of a single MEI (i.e., the same person) being in a position for exposure throughout the entirety of a plant's operating years (60 years) (NRC 2013a, p. 4-145). Thus, while the exposure year over year would result in a cumulative dose, this cumulative dose would be the sum of annual doses that are a small fraction of the regulatory limit. Again, using the 2021 result, 20-years of operation with this low dose would not approach the permitted exposure for a single year.

ONS's REMP is designed to determine if ONS's radioactive effluent releases, including radioactive releases from LLW management and storage at ONS, are leading to an accumulation of radioactivity both onsite and in the surrounding offsite environment. The 2020 and 2021 results indicate that continued operation of ONS has not contributed measurable radiation or the presence of gamma radioactivity in the environmental media monitored and presenting no significant impact on the environment or public safety (Duke 2021b; Duke 2022b).

The concentration of radioactive materials in soils and sediments can accumulate over time, increasing in the environment at a rate dependent on the rate of release and the rate of removal. Removal can take place through radioactive decay or through chemical, biological, or physical

processes. For a given rate of release, the concentrations of longer-lived radionuclides and, consequently, the dose rates attributable to them would continue to increase if license renewal was granted. ONS's REMP's results discussed above indicate that radioactivity is not accumulating, thus supporting the conclusion that public dose would be negligible from continuing operation. ONS continues to release radioactive effluents at a fraction of regulatory limits and now, years into its initial license renewal, the REMP results continue to show no adverse trends in levels of radiation and radioactive materials. Continued operation into a second 20-year renewal term is expected to likewise show that there is not an accumulation of radioactivity. Furthermore, detecting any adverse trends in REMP results would allow for corrective actions to be implemented and ensuring that public dose whether from short- or long-lived radionuclides remains within regulatory limits.

Duke Energy finds that impacts from radiation exposures to the public for the proposed SPEO term would be SMALL.

RADIATION EXPOSURES TO PLANT WORKERS

Affected SLRA Sections:

New ER Section 4.9.4, Radiation Exposures to Plant Workers

4.9.4.1 Generic Analysis for Initial License Renewal [GEIS Section 4.9.1.1.1]

Radiological exposures from nuclear power plants include onsite doses to the workforce. This impact is common to all commercial U.S. reactors. Nuclear power reactors are required to comply with 10 CFR Part 20, Subpart C, “Occupational Dose Limits for Adults.”

In the 2013 license renewal GEIS, the NRC reviewed radiation exposures to plant workers. Occupational dose information collected and reviewed by the NRC in the 2013 license renewal GEIS provides evidence that doses to nearly all radiation workers are far below the worker dose limit established by 10 CFR Part 20 and that the continuing efforts to maintain doses at ALARA levels have been successful. NRC’s GEIS assessment considered the radiological risk to workers to be SMALL, citing 2005 dose. As plants age, there may be slight increases in radioactive inventories, which would result in slight increases in occupational radiation doses. However, it is expected that occupational doses from refurbishment activities associated with license renewal and occupational doses for continued operations during the license renewal term would be similar to the doses during the current operations. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that radiation doses to plant workers from continued operations and refurbishment associated with license renewal would be SMALL. NRC concluded that radiation exposures to plant workers are expected to continue at current levels and would be well below regulatory limits.

4.9.4.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on radiation exposures to plant workers since initial license renewal. The proposed action is to continue to operate ONS as currently designed throughout the SPEO term, and no refurbishment activities are proposed.

The most recent occupational radiation exposure report (NUREG-0713, Volume 41) presents dose data for NRC licensees through 2019. The average collective dose per reactor at PWRs have trended downward since 2005 when the average dose per reactor was 79 person-rem with the exception of a slight increase in 2006 to 87 person-rem (NRC 2022, Table 4.2, and Figure 4.1). The data set presented in the most recent NUREG-0713 covers 1994 through 2019, and this longer timeframe also shows an overall downward trend for average collective dose per reactor. The

middle 50 percent of collective dose per PWR reactors also trended downward since 2005 as well as since 1994 (NRC 2022, Figure 4.4b). The dose performance trend presented for ONS shows that since 2005, ONS's collective dose per reactor was similar to the PWR average collective dose per reactor (NRC 2022, Appendix D).

The individual worker dose at PWRs in 2019 were all below 2 rem, less than half of the 5-rem regulatory limit [10CFR 20.1201(a)(1)] with the highest dose range experienced for PWR workers being 1.0 to 2.0 rem and involving only 16 workers (NRC 2022, Appendix B). ONS's Radiation Protection Program establishes practices and procedures to maintain worker radiation exposure ALARA and monitors worker exposure. Of the 3,215 workers monitored at ONS in 2019, only 715 had a measurable dose and only two workers were in the highest dose range (0.25 to 0.50 rem) recorded at ONS (NRC 2022, Appendix B). The 3-year (2017–2019) average annual occupational dose (total effective dose equivalent) per worker at ONS was 0.045 rem (NRC 2022, Table 4.6). The average for pressure water reactor workers for the same time frame is 0.072 rem. Continued practice of ALARA principles will ensure ONS worker's exposure from continued operations remains within regulatory limits and is ALARA. There are no substantial changes for the ONS Radiation Protection Program currently planned.

Regarding radioactive inventories increasing as plants age, actual data for 2005–2019 demonstrates a downward trend in occupational radiation doses even though the plants are older and inventories of spent nuclear fuel have increased.

The cumulative dose to a worker would increase with each year worked beyond the baseline of a reactor's license term of 40-years. However, as acknowledged by the NRC, an individual worker is not likely to be employed for all 60-years of a reactor's license term. That same logic applies even more so to an SPEO; an individual worker is highly unlikely to be employed for 80-years.

Duke Energy finds that impacts from radiation exposures to plant workers for the proposed SPEO term would be SMALL.

HUMAN HEALTH IMPACT FROM CHEMICALS

Affected SLRA Sections:

New ER Section 4.9.5, Human Health Impact from Chemicals

4.9.5.1 Generic Analysis for Initial License Renewal [GEIS Section 4.9.1.1.2]

Chemical effects could result from discharge of chlorine or other biocides, small-volume discharges of sanitary and other liquid wastes, heavy metals leached from cooling system piping and condenser tubing in plant wastewater effluents, the use and disposal of chemicals and chemical spills, and use and disposal of hazardous chemicals. These chemical effects could pose human health hazards to the public and workers. In the 2013 license renewal GEIS, the NRC reviewed the potential for human health impacts from the chemical effects and these activities. Federal and state environmental agencies regulate the use, storage, and discharge of chemicals, biocides, and sanitary wastes. These environmental agencies also regulate how facilities like a nuclear power plant manage minor chemical spills. The NRC requires nuclear power plants to operate in compliance with all permits, thereby minimizing adverse impacts to the environment and on workers and the public. In the 2013 GEIS, NRC anticipated that all plants will continue to operate in compliance with all applicable permits, and no additional mitigation measures would be warranted for the license renewal term. Based on these considerations, the NRC considered the health impact from chemicals to workers and the public to be SMALL for all nuclear plants (NRC 2013a).

For initial license renewals, the NRC codified its conclusion that human health impacts from chemicals are expected to be SMALL based on (1) chemical hazards to plant workers resulting from continued operations associated with license renewal are expected to be minimized by good industrial hygiene practices as required by permits and federal and state regulations and (2) chemical releases to the environment and the potential for impacts to the public are expected to be minimized by adherence to discharge limitations of NPDES and other permits and regulatory requirements during the proposed SPEO term.

4.9.5.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on human health impact from chemicals since initial license renewal. Plant workers may encounter hazardous chemicals when the chemistries of the primary and secondary coolant systems are being adjusted, biocides are being applied to address the fouling of cooling system components, equipment containing hazardous oils or other chemicals is being repaired or replaced, solvents are being used for cleaning, or other equipment is being repaired. Duke Energy has a comprehensive occupational

safety program covering ONS workers and activities. ONS has a chemical control program to oversee the proper use and storage of chemicals onsite. As presented in ONS SLR ER Section 4.12.8, 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 lower than the nuclear electric power generation industry's rate of 0.2 for 2017 (Duke 2021a). For 2019–2021, ONS had no recordable injuries or illnesses in 2019, one in 2020, and two in 2021 and none were injuries involving skin disorders, respiratory conditions, or poisoning which would be indicative of injuries due to chemical exposure.

As discussed in ONS SLR ER Sections 4.5 and 9.5, ONS operates in compliance with its various wastewater permits and in compliance with waste and chemical management regulations. As reported in ONS SLR ER Section 9.5.13.2, no reportable spills occurred due to ONS operations during January 2014–October 2020. (Duke 2021a) In January 2022, Duke Energy confirmed in its response to NRC Requests for Confirmation following the environmental review audit that only one spill had occurred, a sewage spill in November 2021, and no non-radiological reportable releases had occurred since the ER was written (Duke 2022c). However, as presented in Section 4.5.11.2, another sewage spill occurred in August 2022.

The risk of human health impacts from chemicals could increase over time with the accumulation of chemical substances that do not easily biodegrade, such as heavy metals and PCBs. With Lake Keowee capturing the plant's wastewater and stormwater, the fishery would be the environmental setting to see if accumulation of long-lived chemical substances is indicated. As discussed in ONS SLR ER Section 3.7, various annual biological studies of Lake Keowee demonstrate that the operation of ONS has not resulted in significant harm to the biological community. Lake Keowee's fishery was found to be healthy and balanced.

There are fish consumption advisories for mercury for Lake Keowee (SCDHEC 2020). As a nuclear power plant, ONS is not a major emitter of mercury, and ONS's conditional major operating permit does not require the reporting of HAPs (one of which is mercury.) As shown in ONS SLR ER Appendix B, ONS's NPDES permit does not have metals limits or require monitoring for metals for Outfall 001, the circulating condenser cooling water outfall (Duke 2021a). SCDHEC reviewed the need for a metal limit in the permit and ran a reasonable potential analysis on data reported in Duke Energy's application section 2C, which requires data on the presence and concentration of various metals. As explained in SCDHEC's permit factsheet, the analysis indicated there was no reasonable potential for any other parameters to cause or contribute to a water quality violation from this outfall's discharge. (Duke 2021a, Appendix B) Thus, with regard to ONS operations, there are no indications of an increasing risk to human health from chemicals.

Duke Energy finds that impacts to human health from chemicals for the proposed SPEO term would be SMALL.

MICROBIOLOGICAL HAZARDS TO PLANT WORKERS

Affected SLRA Sections:

New ER Section 4.9.6, Microbiological Hazards to Plant Workers

4.9.6.1 Generic Analysis for Initial License Renewal [GEIS Section 4.9.1.1.3]

In the 2013 license renewal GEIS, the NRC reviewed microbiological hazards because some microorganisms associated with nuclear power plant cooling towers and thermal discharges can have deleterious impacts on the health of plant workers and the public. The GEIS discussion of microbiological hazards focuses on the thermophilic microorganisms Legionella spp. (which can be a hazard during such activities as cleaning condenser tubes and cooling towers) and the pathogenic amoeba, *Naegleria fowleri* (which can be a hazard in cooling water discharges and can also pose a public health hazard). NRC expected that there would be no change in existing microbiological hazards over the license renewal term. NRC considered unlikely that any plants that have not already experienced occupational microbiological hazards would do so during the license renewal term or that hazards would increase over that period. It is anticipated that all plants will continue to employ proven industrial hygiene principles, so that adverse occupational health effects associated with microorganisms will be of SMALL significance at all sites. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that microbiological hazards to plant workers would continue to be SMALL if all plants continue to employ proven industrial hygiene principles.

4.9.6.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on microbiological hazards to plant workers since initial license renewal. Microbiological hazards at ONS for the public and workers is discussed in ONS SLR ER Section 3.10.1 (Duke 2021a). NRC considers microbiological hazards to plant workers to primarily stem from exposure to Legionella spp. from power plant operations to a subset of the workforce. Plant personnel most likely to come into contact with Legionella aerosols would be those who dislodge biofilms, where Legionella are often concentrated, such as during the cleaning of condenser tubes and cooling towers (NRC 2013a, Section 3.9.3.3). ONS does not have cooling towers. Condenser cleaning is accomplished by mechanical means by circulating sponge balls through the tubes to reduce and prevent fouling of the condenser tubes, thus cleaning tubes while the plant is in operation. As presented in ONS SLR ER Section 3.10.1, Duke Energy has a comprehensive health and safety program with procedures that implement industrial hygiene practices to minimize the potential for plant worker exposure (Duke 2021a).

Regarding applicability to a second 20-year renewal, Duke Energy is not proposing changes in the cooling water system or sanitary wastewater treatment and disposal. Further, should the need for changes in these systems arise, they would be carried out under state wastewater permits. The human health impacts from NRC's microbiological organisms of concern are generally from acute exposure rather than chronic exposure.

Duke Energy finds that impacts from microbiological hazards to plant workers for the proposed SPEO term would be SMALL.

PHYSICAL OCCUPATIONAL HAZARDS

Affected SLRA Sections:

New ER Section 4.9.7, Physical Occupational Hazards

4.9.7.1 Generic Analysis for Initial License Renewal [GEIS Section 4.9.1.1.5]

This issue addresses the potential for workers at a nuclear plant to have human health impacts from physical occupational hazards (e.g., slips and trips, falls from height, and those related to transportation, temperature, humidity, electricity, noise, and vibration). In the 2013 license renewal GEIS, the NRC evaluated the issue of occupational hazards by comparing the rate of fatal injuries and nonfatal occupational injuries and illnesses in the utility sector with the rate in all industries combined. The utility sector rates were lower than those of many other sectors. It is expected that over the license renewal term, workers would continue to adhere to safety standards and use protective equipment, so adverse occupational impacts would be of SMALL significance at all sites. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that physical occupational hazards are expected to be SMALL if workers would continue to adhere to safety standards and use protective equipment.

4.9.7.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on physical occupational hazards since initial license renewal. Plant conditions which result in an occupational risk, but do not affect the safety of licensed radioactive materials, are under the statutory authority of OSHA. Work on the ONS site is governed by a comprehensive industrial safety program. ONS adheres to OSHA standard 29 CFR Part 1910 Subpart R, Special Industries, as it relates to Electric Power Generation, Transmission and Distribution, 29 CFR Part 1910.269 (Duke 2022c).

As discussed previously in Section 4.9.5, there were three recordable injuries at ONS reported to OSHA for 2019–2021.The human health impact from most physical hazards would be due to singular events, (e.g., fall) which do not accumulate, and therefore there would be no material difference in human health risk from one renewal term to a subsequent one. The exception would be physical hazards that have a chronic exposure component such as sound level exposure. OSHA regulations address such precautions and continued compliance with OSHA regulations for exposure and use of personal protective equipment. Therefore, there would not be a material difference between the physical hazard risk of the initial 20-year renewal and a second.

Duke Energy finds that impacts from physical occupational hazards for the proposed SPEO term would be SMALL.

DESIGN-BASIS ACCIDENTS

Affected SLRA Sections:

ER Section 4.15.1, Design-Basis Accidents

4.15.1.1 Generic Analysis for Initial License Renewal [GEIS Section 4.9.1.2]

4.15.1.1.1 Design-Basis Accidents

Section 5.3 of the 1996 GEIS (NRC 1996) discusses the impacts of potential accidents, their consequences, and addresses the general characteristics of DBAs, including characteristics of fission products, meteorological considerations, possible exposure pathways, potential adverse health effects, avoiding adverse health effects, accident experience and observed impacts, and emergency preparedness. In the 2013 license renewal GEIS (NRC 2013a), the NRC reexamined the information from the 1996 GEIS regarding DBAs and concluded that this information is still valid. The NRC found that the environmental impacts of DBAs are of SMALL significance for all nuclear plants. This conclusion was reached because the plants were designed to successfully withstand these accidents, and a licensee is required to maintain the plant within acceptable design and performance criteria, including during any license renewal term.

4.15.1.1.2 Impacts of Severe Accidents

There are two aspects of severe accidents considered for license renewal. These aspects are the “impact” of severe accidents and “mitigation alternatives” to severe accidents. The “mitigation alternatives” related to severe accidents is a Category 2 issue, addressed in the ONS SLRA ER, and are not required to be supplemented here. The “impacts” of severe accidents is addressed in the 2013 GEIS, where the NRC confirmed the findings of the 1996 GEIS are still valid and concluded 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 for all plants.”

The postulated accidents include severe accidents (e.g., those with core damage). The impacts considered included:

- Dose and health effects of accidents
- Economic impacts of accidents; and
- Impact of uncertainties on results.

4.15.1.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke considered relevant new information for design basis accidents and severe accidents since initial license renewal.

4.15.1.2.1 Design Basis Accidents

To receive NRC approval to operate a nuclear power facility, an applicant must submit a safety analysis report (SAR) as part of its application. The ONS SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The ONS SAR also discusses various hypothetical design basis accidents and the safety features designed to prevent and mitigate accidents.

A number of the postulated accidents are not expected to occur during the life of the plant but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in 10 CFR Part 50 and 10 CFR Part 100. The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents was demonstrated to be acceptable before issuance of the operating license. The results of these evaluations are found in licensing documentation such as the NRC staff's safety evaluation report, the final environmental impact statement, and the licensee's final safety analysis report.

The licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant including any extended-life operation. The consequences for these postulated accidents are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment will not affect these evaluations. Additionally, during the integrated plant assessment for the subsequent license renewal application, the license renewal team evaluated ONS systems, structures, and components and conducted time-limited aging analyses to ensure that systems, structures, and components remain capable of performing their functions consistent with existing plant design and performance criteria specified in the ONS licensing basis. Current design and performance criteria will be maintained during SPEO (Duke 2021a).

When the 2013 GEIS was issued, the NRC's review of updated external hazards information for all operating power reactors (as ordered by the Commission following the Fukushima Dai-Ichi accident) remained ongoing. On November 17, 2020 (NRC 2020), the NRC completed its review of such information as to ONS and concluded that no further regulatory actions were needed to ensure adequate protection or compliance with regulatory requirements, including site-specific external hazards information, re-confirming the acceptability of ONS's design basis.

The environmental impacts during a license renewal term do not differ significantly from those calculated for the DBA assessments conducted as part of the initial plant licensing process. Impacts from DBAs are not affected by changes in plant environment because such impacts (1)

are based on calculated radioactive releases that are not expected to change; and (2) are not affected by plant environment because they are evaluated for the hypothetical maximally exposed individual.

4.15.1.2.2 Impacts of Severe Accidents

The assessment process for relevant new information for severe accidents includes 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 during initial license renewal, which includes:

- Internal Events Information
- Consideration of External Events
- New Source Term Information
- Power Uprates
- Higher Fuel Burnup
- Consideration of Accidents at Low Power and Shutdown Conditions
- Consideration of Accidents at Spent Fuel Pools
- Use of Biological Effects of Ionizing Radiation (BEIR) VII Risk Coefficients
- Uncertainties
- Other Considerations - Risk-Beneficial Plant Changes

The review of relevant new information was informed by the current ONS PRA. 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 initiating event and equipment performance data using the updated industry and plant specific sources. The PRA models have been updated to reflect 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 subsections below summarize the developments that were considered.

New Internal Events Information

For developments in internal events, Core Damage Frequency (CDF) at all three ONS units is comparable and slightly lower than the initial license renewal analysis that was performed. Improvements in safety at ONS since the initial license renewal analysis account for significant risk reduction but have been offset by refinements in PRA methodology (e.g., treatment of dependency between human actions). Regardless, quantitative PRA evaluations using updated internal events models show the absence of any significant impact to the SAMA analysis. Considering the plant improvements to reduce internal events risk, and the conservative dose values used in the 1996 GEIS (as discussed in Uncertainties below), for

ONS the offsite consequences of severe accidents initiated by internal events during the SPEO would not exceed the impacts predicted in the 1996 GEIS.

Consideration of External Events

The ONS External Events PRA includes fires, seismic events, high winds, and external floods. Since initial license renewal, the external events PRA has been improved to meet ASME/ANS standards for fire, seismic, and high winds. The contribution from transportation, pipeline, and nearby facility accidents are negligible and therefore, not included in the ONS external events PRA.

The external events CDF at all three ONS units is comparable to the initial license renewal analysis that was performed. Improvements in safety at ONS since the initial license renewal analysis have provided significant risk reduction but have been offset by refinements in PRA methodology and conservative analysis assumptions. Regardless, quantitative PRA evaluations using updated external events models show the absence of any significant impact to the SAMA analysis. Additionally, for ONS, the offsite consequences contributions from ONS external events are comparable to the 1996 GEIS for external events in all PWRs.

For ONS, considering the improvements in plant safety, conservative analysis assumptions, and the conservative dose values used in the 1996 GEIS (as discussed in Uncertainties below), the offsite consequences of severe accidents initiated by external events during the SPEO would not exceed the impacts predicted in the 1996 GEIS.

New Source Term Information

A comparison of NRC studies from NUREG-0773 (NRC 1982) and NUREG/CR-6295 (NRC 1997a) concluded that the release frequencies and release fractions estimated were significantly lower than previously estimated. Thus, the environmental impacts used in the 1996 GEIS as the basis for the probability-weighted consequences were higher than impacts that would be estimated using the 1997 source term information.

Volume 2 of NUREG- 7110 State-of-the-Art Reactor Consequence Analysis (SOARCA) updated the NRC's severe accident studies of the Surry Power Station (SPS), incorporating state-of-the-art analyses to evaluate offsite risk (NRC 2013b). The conclusions of the SOARCA analysis were that:

> *"… the calculated risks of public health consequences from severe accidents modeled in SOARCA are very small."* And
>
> *"The unmitigated versions of the scenarios analyzed in SOARCA have lower risk of early fatalities than calculated in the 1982 Siting Study SST1 case. SOARCA's analyses show essentially zero risk of early fatalities."*

Based on the NRC findings of the SOARCA, Duke concludes that the offsite effects from a severe accident are small. While ONS is not an identical design as SPS, both are PWRs with large, dry containments, and the general conclusions of lower offsite consequences from the SOARCA apply to ONS as well. Thus, the environmental impacts used as the basis for the 1996 GEIS are higher than the impacts that would be estimated using the more recent source term information.

Duke Energy reviewed and determined that the previously evaluated source terms used in the initial license renewal SAMA analysis to assess offsite radiological consequences of severe accidents are bounded by the conclusions of the 1996 GEIS.

Power Uprates

ONS has not implemented any power uprates as of the time of this application, but the NRC has approved a measurement uncertainty recapture (MUR) power uprate (NRC 2021). As described in the application of MUR power uprate, the change in thermal power from 2568MWt to 2610MWt is a small increase of 1.6 percent. The effect of this on PRA success criteria and timing for operator actions is insignificant.

Higher Fuel Burnup

Considering higher burnup fuel, 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). As provided in NUREG/CR-6703, NRC has concluded that there are no significant adverse environmental impacts associated with extending peak rod fuel burnup to 62 GWd/MTU (NRC 2001a).

Consideration of Low Power and Shutdown Events

As discussed in SECY 97-168, existing regulatory controls for shutdown operations have evolved through a series of industry actions which have been successful in achieving an acceptable level of safety of low power and shutdown operation. (NRC 1997b). Therefore, the offsite consequences of severe accidents, considering low power and shutdown events, would not exceed the impacts predicted in the 1996 GEIS.

Further, as a result of the NFPA-805 risk informed fire protection program at ONS, for high-risk evolutions during non-power operations, fire areas are assessed to ensure the nuclear fuel remains in a safe stable condition. In fire areas where key safety functions may be degraded, risk management measures are defined and implemented to meet the nuclear safety goals of NFPA-805.

Consideration of Spent Fuel Pool Accidents

Consistent with NUREG-1738 (NRC 2001b), the impacts of accidents in SFPs at ONS is comparable to or lower than those from reactor accidents. Analyses performed and mitigative measures employed since 2001 have further lowered the risk of accidents involving SFPs.

As a result of post-Fukushima NTTF 2.1 recommendations, implementation of diverse and flexible coping strategies (FLEX) provides additional resources to maintain SFP water inventory and risk reduction. (NRC 2020).

Use of BEIR VII Risk Coefficient

The risk coefficients from BEIR VII are applicable to the health effects from radiation exposures and cancers associated with them. As stated in SECY-05-0202, “the major conclusion is that current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose response relationship between exposure to ionizing radiation and the development of cancer in humans. This conclusion is consistent with the system of radiological protection that the NRC uses to develop its regulations. Therefore, the NRC’s regulations continue to be adequately protective of public health and safety and the environment.” (NRC 2005). Therefore, the impacts of from BEIR VII would be small.

Because the ONS SAMA analysis does not find any SAMAs that reduced the risk metrics by at least 50 percent, no offsite doses are computed as part of a full Level 3 evaluation. Therefore, the BEIR VII risk coefficients have no impact on the ONS SAMA Stage 1 analysis, and there is no relevant new information. Further, the plant risk has improved through significant modifications since the initial license renewal, some of which are listed in the “Other Considerations” subsection below.

Uncertainties

The 1996 GEIS used 95th percentile upper confidence bound (UCB) estimates whenever available for its estimates of the environmental impacts of severe accidents. The 2013 GEIS states that “a comparison of population dose from newer assessments illustrates a reduction in impact by a factor of 5 to 100 when compared to older assessments, and an additional factor of 2 to 4 due to the conservatism built into the 1996 GEIS values.” The 1996 GEIS used an ONS specific Predicted UCB total dose value of 1311 person-rem/reactor-year (NRC 2013a, Table 5-9). This can be compared to the ONS initial license renewal specific dose calculation of 4.92 person-rem/reactor year (NRC 1999, Table 5-4). For ONS, this factor of population dose reduction from newer information is on the order of a factor of 266. Considering additional plant improvements since the initial license renewal, this dose reduction factor remains valid for the SPEO.

Other Considerations (population increase and risk-beneficial plant changes)

Another consideration for uncertainty is population growth. According to NEI 17-04, Rev. 1, Section 2.1, population growth is considered new information, but not necessarily significant for the Stage 1 analysis. Detailed population information including population projection information is presented in Section 3.11.1, "Regional Population" of the SLR ER (Duke 2021a). For the 50-mile radius from the plant, the 2010 permanent population was 1,394,743, and the projected 2054 permanent and transient population is 2,213,662. Using this data, the 50-mile radius projected 2034 population is 1,794,410, which translates to a total growth of 23.4 percent over the SPEO, which would not result in a significant increase in impacts.

A number of plant improvements have been made since the initial license renewal to lower overall plant risk, including the following:

- Upgraded Oconee Unit 1 Westinghouse Reactor Coolant Pump (RCP) seals to a low leakage seal design.
- Replaced the station ASW system (pump and power system) with the Protected Service Water (PSW) System, which provides enhanced capability to restore steam generator cooling, Reactor Coolant System (RCS) makeup, and RCP seal injection.
- Installed backup AC power connection for the Safe Shutdown Facility (SSF) from PSW switchgear.
- Upgraded the west penetration room masonry walls to withstand tornado wind and differential pressure.
- Added Borated Water Storage Tank (BWST) tornado missile protection.
- Installed additional tornado missile protection for SSF cabling for portions of west penetration room and SSF cable trench.
- Installed reliable spent fuel pool instrumentation in response to NRC Order EA-12-051.
- Implemented diverse and flexible coping strategies features and capabilities in response to NRC Order EA-12-049
- Enhanced external flood protection for post-Fukushima response.
- Improved closure capability of valve HP-5 to isolate containment following a seismic event (in progress).

Based on discussions provided in ER 4.15.1.2.2, Duke concludes that for ONS, the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents remains SMALL for the SPEO.

4.15.1.2.3 Conclusion

Duke finds that collectively, the Site-Specific Analysis demonstrates that impacts to design basis accidents and severe accidents for the SPEO are SMALL.

LOW-LEVEL WASTE STORAGE AND DISPOSAL

Affected SLRA Sections:

ER Section 4.11.1, Low-Level Waste Storage and Disposal

4.11.1.1 Generic Analysis for Initial License Renewal [GEIS Section 4.11.1.1]

In the 2013 GEIS, NRC considered the comprehensive regulatory controls that are in place for management of low-level waste (LLW) and the low public doses being achieved at reactors. NRC concluded that the comprehensive regulatory controls and the low public doses experienced at reactors ensured that the radiological impacts on the environment will remain SMALL during the term of a renewed license.

In the 2013 GEIS, NRC also considered the impact of LLW disposal. NRC concluded that (1) the maximum additional onsite land that may be required for LLW storage during the term of a renewed license and associated impacts would be SMALL, (2) non-radiological impacts on air and water would be negligible, and (3) the radiological and non-radiological environmental impacts of long-term disposal of LLW from any individual plant at licensed sites are SMALL. In addition, NRC's analysis also accounted for the availability of licensed disposal facilities to the nuclear power plant operators. The NRC concluded 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. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL with the comprehensive regulatory controls and use of licensed LLW storage and disposal facilities.

4.11.1.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on low-level waste storage and disposal since initial license renewal. Duke Energy will continue to manage and store LLW onsite as described in ER Section 2.2.6, in accordance with NRC regulations, and dispose of LLW in NRC-licensed treatment and disposal facilities during the proposed SPEO term (Duke 2021a). Currently, there are no projects funded or planned for the future that would produce any significant changes in the volume of radwaste produced from year to year moving forward. No changes in onsite management or increases in onsite storage capacity are anticipated for the current or subsequent license renewal term.

In the 2013 GEIS, NRC considered the availability of landfill space for disposal of LLW with regard to available capacity and availability of disposal facilities. NRC presented that only three disposal facilities were licensed and only one of those, EnergySolutions in Clive, Utah, was available to all

nuclear power plant operators and only for LLW Class A. At that time, the Texas facility, Waste Control Specialists, was in the process of expanding its availability to all nuclear power plant operators for LLW Class A, B, and C. With these limited disposal options, NRC concluded in the 2013 GEIS (1) the "maximum additional onsite land that may be required for LLW storage during the term of a renewed license and associated impacts would be SMALL" and (2) "that there is reasonable assurance that sufficient LLW disposal capacity will be made available when needed for facilities to be decommissioned [which would involve much greater LLW volumes] consistent with NRC decommissioning requirements." These three facilities remain open, and the Texas facility is available to all states. Both the Clive, Utah and Texas facilities have expanded their services (EnergySolutions 2016 and WCS 2022). Furthermore, treatment facilities are available that can result in smaller volumes of LLW that require disposal (EnergySolutions 2016 and WCS 2022). ONS located in South Carolina also has the option of disposal at the Atlantic Compact facility in Barnwell, South Carolina. Therefore, Duke Energy anticipates that available LLW disposal will be sufficient for LLW volumes generated by ONS during a SPEO term.

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 SPEO term. As discussed in ONS SLR ER Section 3.10.3, Duke Energy's annual reports for 2014-2019 indicate that doses to members of the public were in accordance with NRC and EPA radiation protection standards (Duke 2021a). Review of the annual radiological effluent release reports for 2020 and 2021 indicate that doses to the public are within regulatory limits (Duke 2021c and Duke 2022a).

ONS's REMP is designed to determine if ONS's radioactive effluent releases, including radioactive releases from LLW management and storage at ONS, are leading to an accumulation of radioactivity both onsite and in the surrounding offsite environment. The 2020 and 2021 results indicate that continued operation of ONS has not contributed measurable radiation, or the presence of gamma radioactivity, in the environmental media monitored, presenting no significant impact on the environment or public safety (Duke 2021b and Duke 2022b). Thus, the REMP results indicate that radioactivity is not accumulating in environmental media after 49-years of operation (1973 to 2022).

The radiological impacts from disposal of waste generated during a SPEO term has the potential to increase as long-lived radionuclides accumulate at disposal facilities. However, the disposal facilities would be licensed, which means the facility would be designed to minimize environmental impacts, including design capacity and conditions of operation.

Duke Energy finds that impacts to low-level waste storage and disposal for the proposed SPEO term would be SMALL.

ONSITE STORAGE OF SPENT NUCLEAR FUEL

Affected SLRA Sections:

ER Section 4.11.2, Onsite Storage of Spent Nuclear Fuel

4.11.2.1 Generic Analysis for Initial License Renewal [GEIS Section 4.11.1.2]

As discussed in Section 3.11.1.2 of the 2013 GEIS, spent nuclear fuel is currently stored at reactor sites either in spent fuel pools or in independent spent fuel storage installations (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. (NRC 2013a)

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 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 (NRC 2014, ES.12 and Table ES-3).

For initial license renewals, the NRC codified its conclusion that, during the license renewal term, 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. The NRC found the impact for this issue to be SMALL.

4.11.2.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on onsite storage of spent nuclear fuel since initial license renewal. For on-site storage of spent fuel during the license renewal term, Table B-1 was amended after the 2013 GEIS by the Continued Storage Rule (79 FR 56238) to codify the Commission’s determination that the impacts would be SMALL. This rulemaking postdates the LR GEIS rulemaking in 2013, and the codified impact determination was not overturned by the NRC’s CLI-22-02 Order. The Continued Storage Rulemaking explicitly considered subsequent license renewals, stating in Footnote 3 at page 56245 of the Rulemaking:

"The Commission's regulations provide that renewed operating licenses may be subsequently renewed…The GEIS [Continued Storage of Spent Nuclear Fuel GEIS] assumes two renewals in evaluating potential environmental impacts." Pursuant to the Commission's generic analysis and codified conclusion, the impacts of onsite storage of spent fuel during the SPEO at ONS are SMALL.

OFFSITE RADIOLOGICAL IMPACTS OF SPENT NUCLEAR FUEL AND HIGH-LEVEL WASTE DISPOSAL

Affected SLRA Sections:

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

4.11.3.1 Generic Analysis for Initial License Renewal [GEIS Section 4.11.1.3]

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 prepared NUREG-2157, Generic EIS for Continued Storage of Spent Nuclear Fuel (NRC 2014, Sections ES.7 and ES.16). In the final continued storage of nuclear spent fuel rulemaking (79 FR 56238), the listing and classification of license renewal issues found in 10 CFR 51, Subpart A, Appendix B, Table B-1 was codified to classify the impact determination for this issue as generic with no impact level assigned. The NRC concluded that the impacts would not be sufficiently large to preclude the option of extended operation under 10 CFR Part 54 for any plant.

4.11.3.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on offsite radiological impacts of spent nuclear fuel and high-level waste disposal since initial license renewal. For offsite radiological impacts of spent fuel during the license renewal term, Table B-1 was amended after the 2013 GEIS by the Continued Storage Rule (79 FR 56238). Thus, this rulemaking postdates the LR GEIS rulemaking in 2013, and the codified impact determination was not overturned by the NRC's CLI-22-02 Order. The Continued Storage Rulemaking explicitly considered subsequent license renewals, stating in Footnote 3 at 79 FR 56245: "The Commission's regulations provide that renewed operating licenses may be subsequently renewed…The GEIS [Continued Storage of Spent Nuclear Fuel GEIS] assumes two renewals in evaluating potential environmental impacts." Thus, pursuant to the Commission's codified conclusion, with regard to this issue's consideration for ONS's SLR, the offsite radiological impacts of spent nuclear fuel have no impact level assigned but the impact would not be sufficiently large to preclude the option of extended operation under 10 CFR Part 54.

MIXED-WASTE STORAGE AND DISPOSAL

Affected SLRA Sections:

ER Section 4.11.4, Mixed-Waste Storage and Disposal

4.11.4.1 Generic Analysis for Initial License Renewal [GEIS Section 4.11.1.4]

In the 2013 license renewal GEIS, the NRC reviewed mixed waste storage and disposal. Several factors associated with the guidance for handling, storing, and disposing of mixed waste were considered by the NRC in the 2013 license renewal GEIS (NRC 2013a, Section 4.11.1.4). The NRC determined that the comprehensive regulatory controls and the facilities and procedures 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. The NRC review revealed that license renewal will not increase the small but continuing risk to human health and the environment posed by mixed waste at all plants and that radiological and non-radiological environmental impacts from the long-term disposal of mixed waste from any individual plant at licensed sites were minimal.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL with the comprehensive regulatory controls and use of licensed mixed waste storage and disposal facilities.

4.11.4.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on mixed-waste storage and disposal since initial license renewal. 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 mixed waste placed in storage at ONS storage units listed under the exemption. No changes in onsite management or increases in onsite storage capacity of mixed waste are anticipated for the current or subsequent license renewal term. If generated, mixed waste would be managed onsite in accordance with NRC regulations and the conditional exemption requirements. The waste would be transferred to a licensed vendor for treatment and disposal. As discussed for LLW in Section 4.11.1, Duke Energy anticipates that available LLW disposal will be sufficient for LLW (inclusive of mixed waste) volumes generated by ONS during a SPEO term.

The impacts from disposal of mixed waste generated during a SPEO has the potential to increase as long-lived radionuclides, chemicals, and metals accumulate at disposal facilities. However, the

disposal facilities would be licensed and permitted, which means the facility would be designed (inclusive of a design capacity and conditions of operation) to minimize environmental impacts.

Duke Energy finds that impacts to mixed-waste storage and disposal for the proposed SPEO term would be SMALL.

NONRADIOACTIVE WASTE STORAGE AND DISPOSAL

Affected SLRA Sections:

ER Section 4.11.5, Nonradioactive Waste Storage and Disposal

4.11.5.1 Generic Analysis for Initial License Renewal [GEIS Section 4.11.1.5]

In the 2013 license renewal GEIS, the NRC considered that nuclear plants generate small quantities of hazardous waste (including universal waste) during operation and refurbishment. The management of hazardous wastes generated at all 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. (NRC 2013a)

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. NRC affirmed this finding in the 2013 GEIS. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL with the comprehensive regulatory controls and in place to ensure continued proper handling, storage, and disposal of nonradioactive waste.

4.11.5.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on nonradioactive waste storage and disposal since initial license renewal. ONS is a small quantity hazardous waste generator. Management of nonradioactive waste is discussed in ONS SLR ER Section 2.2.7 (Duke 2021a). 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. Waste disposal would take place in appropriately permitted treatment and disposal facilities during the proposed SPEO 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.

The impacts from disposal of hazardous waste generated during a SPEO term has the potential to increase as long-lived toxic metals accumulate at disposal facilities. However, the disposal facilities would be permitted, which means the facility would be designed (inclusive of design capacity and conditions of operation) to minimize environmental impacts. Furthermore, ONS operations generate small quantities of hazardous waste.

Duke Energy finds that impacts to nonradioactive waste storage and disposal for the proposed SPEO term would be SMALL.

OFFSITE RADIOLOGICAL IMPACTS - INDIVIDUAL IMPACTS FROM OTHER THAN THE DISPOSAL OF SPENT FUEL AND HIGH-LEVEL WASTE

Affected SLRA Sections:

ER Section 4.13.1, Offsite Radiological Impacts – Individual Impacts from Other than the Disposal of Spent Fuel and High-Level Waste

4.13.1.1 Generic Analysis for Initial License Renewal [GEIS Section 4.12.1.1]

In the 2013 license renewal GEIS, the NRC reviewed generic issues related to the uranium fuel cycle including offsite radiological impacts. As stated in the 2013 license renewal GEIS, the generic issues related to the uranium fuel cycle would not be affected by continued operations associated with license renewal of nuclear power plants.

The impacts to the public from radiological exposures were considered by the NRC in Table S-3 of 10 CFR 51.51. Impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99 would remain at or below regulatory limits as long as facilities operate under a valid license issued by either the NRC or an agreement state. NRC affirmed this conclusion in the 2013 license renewal GEIS. For initial license renewals, the NRC codified its conclusion that the impacts to the public from radiological exposures have been considered by the NRC in Table S-3 of 10 CFR 51.51and the impacts would be SMALL. Based on information in the 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 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on offsite radiological impacts - individual impacts from other than the disposal of spent fuel and high-level waste since initial license renewal. This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants.

As stated above, impacts to individuals from radioactive gaseous and liquid releases would remain at or below regulatory limits as long as facilities operate under a valid license issued by either the NRC or an agreement state. ONS's nuclear fuel is supplied by vendors with the appropriate licenses and as discussed in ONS SLR ER Section 2.2.6.4, radioactive waste services are contracted with facilities having the appropriate licenses and permits (Duke 2021a). This determination would apply to a SPEO as well because ONS would continue to utilize facilities with the appropriate licenses and permits.

Duke Energy finds that impacts to offsite radiological impacts – individual impacts from other than the disposal of spent fuel and high-level waste for the proposed SPEO term would be SMALL.

OFFSITE RADIOLOGICAL IMPACTS - COLLECTIVE IMPACTS FROM OTHER THAN THE DISPOSAL OF SPENT FUEL AND HIGH-LEVEL WASTE

Affected SLRA Sections:

ER Section 4.13.2, Offsite Radiological Impacts – Collective Impacts from Other than the Disposal of Spent Fuel and High-Level Waste

4.13.2.1 Generic Analysis for Initial License Renewal [GEIS Section 4.12.1.1]

In the 2013 license renewal GEIS, the NRC reviewed offsite radiological impacts. As stated in the GEIS (NRC 2013a), the generic issues related to the uranium fuel cycle would not be affected by continued operations associated with license renewal.

In the GEIS, NRC considers that fuel cycle facilities are designed and operated to meet the applicable regulatory limits. Regulatory limits are based on individual doses and there are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. (NRC 2013a)

The NRC concludes that offsite radiological 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. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that offsite collective radiological impacts are not expected to be sufficiently large to preclude the option of extended operation under 10 CFR 54 for any plant. Accordingly, the NRC did not assign a single level of significance for the collective impacts of the uranium fuel cycle and considered its findings to be applicable to all plants.

4.13.2.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on offsite radiological impacts – collective impacts from other than the disposal of spent fuel and high-level waste since initial license renewal. This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants.

As stated above, fuel cycle facilities are designed to meet the applicable regulatory limits and standards and as long as facilities operate under a valid license issued by either the NRC or an agreement state, regulatory requirements would be met (NRC 2013a). ONS's nuclear fuel is supplied by vendors with the appropriate licenses, and as discussed in ONS SLR ER 2.2.6.4 (Duke 2021a), radioactive waste services are contracted with facilities having the appropriate licenses

and permits. This determination would apply to a second license renewal term as well because ONS would continue to utilize facilities with the appropriate licenses and permits.

Duke Energy finds that impacts to offsite radiological impacts – collective impacts from other than the disposal of spent fuel and high-level waste for the proposed SPEO term would be SMALL.

NON-RADIOLOGICAL IMPACTS OF THE URANIUM FUEL CYCLE

Affected SLRA Sections:

ER Section 4.13.3, Non-Radiological Impacts of the Uranium Fuel Cycle

4.13.3.1 Generic Analysis for Initial License Renewal [GEIS Section 4.12.1.1]

In the 2013 license renewal GEIS, the NRC reviewed generic issues related to the uranium fuel cycle including non-radiological impacts. As stated in the 2013 license renewal GEIS, the generic issues related to the uranium fuel cycle would not be affected by continued operations associated with license renewal of nuclear power plants. Data on the non-radiological impacts of the fuel cycle are provided in Table S-3 of 10 CFR 51.51. 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 and affirmed in the 2013 GEIS. (NRC 2013a)

For initial license renewals, the NRC codified its conclusion that the non-radiological impacts of the uranium fuel cycle resulting from the renewal of an OL for any plant would be SMALL.

4.13.3.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on non-radiological impacts of uranium fuel cycle since initial license renewal. This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants.

Non-radiological environmental impacts would remain at or below regulatory or permit limits as long as fuel cycle facilities operate in accordance with their federal, state, and local environmental permits. This would apply to a SPEO as well.

ONS's nuclear fuel is supplied by vendors with the appropriate licenses and permits and radioactive waste services are contracted with facilities having the appropriate licenses and permits. ONS would continue to utilize facilities with the appropriate licenses and permits during a SPEO.

Duke Energy finds that non-radiological impacts of the uranium fuel cycle for the proposed SPEO term would be SMALL.

TRANSPORTATION

Affected SLRA Sections:

ER Section 4.13.4, Transportation

4.13.4.1 Generic Analysis for Initial License Renewal [GEIS Section 4.12.1.1]

In the 2013 license renewal GEIS, the NRC reviewed transportation. The impacts associated with transporting fresh fuel and spent fuel and radioactive waste (LLW and mixed waste) are provided in Table S-4 in 10 CFR 51.52. In the 2013 GEIS, the NRC confirmed 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. (NRC 2013a)

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 2014, ES.16.2.16).

For initial license renewals, the NRC codified its conclusion that the transportation impacts of the uranium fuel cycle resulting from the renewal of an OL for any plant would be SMALL provided the following three conditions are met: (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 five years before being shipped offsite.

4.13.4.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on transportation since initial license renewal. 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 SPEO term to be below 5 percent. As discussed in ONS SLR ER 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 SPEO term. Furthermore, as presented in ONS SLR ER Section 2.2.6, spent fuel is stored onsite in spent fuel pools for adequate cooling prior to transfer to onsite dry storage. (Duke 2021a)

ONS 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 radioactive wastes and spent nuclear fuel. Given that ONS meets the three criteria discussed above and radioactive waste

shipping procedures to implement regulatory requirement, Duke Energy finds that impacts from ONS's contribution to offsite radiological impacts from transportation of fuel and radiological waste would be SMALL.

Regarding the incremental effects of an initial 20-year renewal period and a second 20-year renewal period, the impacts (e.g., direct radiation) of a transportation event would be discrete from other transportation events and accumulation of dose by the public other than persons in the cab of a truck transporting the material on subsequent trips would be unlikely. The packaging of radioactive materials in accordance with NRC and DOT regulations would minimize exposure. Further, the transportation events are unlikely to be staffed by the same person throughout a license term and into a second.

Duke Energy finds that impacts of transportation of fuel and radiological wastes for the proposed SPEO term would be SMALL.

TERMINATION OF PLANT OPERATIONS AND DECOMMISSIONING

Affected SLRA Sections:

ER Section 4.14, Termination of Plant Operations and Decommissioning

4.14.1 Generic Analysis for Initial License Renewal [GEIS Sections 4.12.2 and 4.12.2.1]

The impacts of decommissioning nuclear plants were evaluated in 2002 by the NRC in NUREG-0586, Generic Environmental Impact Statement for Decommissioning Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors. In the 2013 license renewal GEIS, the NRC confined the scope of this issue to the effects of an additional 20 years of operation on the impacts of decommissioning. NRC found that license renewal delays the date of reactor shutdown and decommissioning but does not alter the impact levels anticipated to result from the eventual termination of operations and decommissioning. The GEIS describes and discusses the environmental consequences of terminating nuclear power plant operations and decommissioning, relying on the 2002 GEIS analysis for decommissioning impacts. 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 onsite 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.

For initial license renewals, the NRC codified its conclusion that impacts are expected to be SMALL. License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.

4.14.2 Site-Specific Analysis for ONS SPEO

As part of the Site-Specific Analysis, Duke Energy considered relevant new information on termination of plant operation and decommissioning since initial license renewal. Only the incremental increase in the impacts of termination of plant operations and decommissioning attributable to continued operation during the proposed SPEO term is within the scope of this issue.

The potential for the additional operating years to alter the impacts attributable to termination of plant operations or decommissioning is presented by resource area in Table 4.14-1.

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. Decommissioning and site restoration activities would be conducted in accordance with state and local regulations and permits, ensuring that environmental impacts would be SMALL. It is anticipated that permit conditions would account for local current environmental conditions such as air and water temperature and surface water conflicts or availability at the time of decommissioning whether decommissioning proceeds after ceasing operations or the station is placed in safe storage and decommissioning delayed. It is noted that once operations cease, ONS's water withdrawals would reduce greatly and the thermal discharge as a result of condenser cooling would cease.

Table 4.14-1: Site-Specific Impacts of License Renewal on Termination of Operations and Decommissioning

Issue	Impact
Land use	The proposed action does not include a change in onsite land use. No additional workers whose housing could affect offsite land use are proposed. Therefore, the land needed for and impacted by decommissioning activities would not be changed by the additional 20 operating years.
Visual resources	No additional facilities were proposed to continue operation for another 20 years; therefore, the visual impact of the plant at the end of the current license term as well as the end of the proposed SPEO term would be the same. There would be no visual impact during decommissioning as a result of the additional 20 years of operation.
Air quality	During the proposed SPEO term, appropriate permit conditions would regulate and mitigate any potential ONS activities that could increase air pollutants. Furthermore, no temporary impacts associated with refurbishment activities are expected. Therefore, there would be no additional impacts to air quality during decommissioning as a result of the additional 20 years of operation.
Noise	Noise levels at the end of the current license renewal term and at the end of the proposed SPEO term would be the same with the exception of an improvement gained by no further monthly testing of EDGs after decommissioning. No additional impacts related to noise would occur as a result of extending the operation of the plant by an additional 20 years.
Geology and soils	With no construction planned during the proposed SPEO term, there would be no additional impacts to geology and soils from decommissioning as a result of the 20-year SLR term.
Surface water	No significant surface water impacts are anticipated during the SPEO term that would be different from those occurring during the current license term. Therefore, there would be no change in the impacts to surface water during decommissioning as a result of the additional 20 years of operation.

Issue	Impact
Groundwater	No significant groundwater impacts are anticipated during the SPEO term that would be different from those occurring during the current license term. Therefore, there would be no change in the impacts to groundwater during decommissioning as a result of the additional 20 years of operation.
Terrestrial	Terrestrial resources can be impacted by landscape maintenance, stormwater management, elevated noises levels, and other ongoing operations and maintenance activities. However, these impacts are not different from current site activities and would remain the same throughout the proposed SPEO term. Therefore, there should be no additional impacts on terrestrial resources during decommissioning as a result of the additional 20 years of operation.
Aquatic	Aquatic resources can be impacted by landscape maintenance, stormwater management, effluent discharge, and other ongoing operations and maintenance activities. However, these impacts are not different from current site activities and would remain the same throughout the proposed SPEO term. Therefore, there should be no additional impacts on terrestrial resources during decommissioning as a result of the additional 20 years of operation.
Special status species	No SLR-related refurbishment activities have been identified. Therefore, there would be no SLR-related refurbishment impacts to important plant and animal habitats. Therefore, there should be no additional impacts on special status species during decommissioning as a result of the additional 20 years of operation.
Historic and cultural resources	ONS has a low archeological potential and current site infrastructure will be utilized during the proposed SPEO term. For these reasons, the potential impact of decommissioning activities on cultural resources would not change as a result of the additional 20 years of operation.
Socioeconomics	ONS has no plans to add non-outage workers during the proposed SPEO term, does not anticipate changes in tax payments, and has no plans for refurbishment. Duke Energy expects its beneficial impact on the local taxing entities to continue during the SPEO term. The tax revenue socioeconomic impact of termination of operations would not be appreciably affected by the additional years of operation under a SLR. Therefore, impacts under the SPEO term from the additional 20 years of operation will not impact decommissioning activities.
Human health	Continued operation of ONS through the proposed SPEO term would not change the current exposure to physical, chemical, and microbiological hazards, or risks of accidents than those currently in existence and controlled by accepted industrial hygiene practices as required by permits and federal and state regulations. Chemical releases to the environment and the potential for impacts to the public are expected to continue to be minimized by adherence to discharge limitations of the NPDES and other permits. Radiation doses are expected to continue at current levels during the proposed SPEO term and would be well below regulatory limits. Due to adherence to ongoing practices, the additional 20 years of operation will not impact decommissioning efforts.

Issue	Impact
Environmental justice	Duke Energy has determined that minority and low-income populations within a 50-mile radius of ONS will not be at risk of impact from continued operations associated with the proposed SPEO term. Radiation doses from continued operations would continue at current levels and would remain within regulatory limits. Terrestrial and aquatic monitoring programs conducted by ONS are designed to ensure contaminants are not entering natural systems that would impose a risk to the environment or the public. As operations during the proposed SPEO term will continue with current monitoring activities and compliance with existing regulations, the additional 20 years of operation would have no impact on decommissioning.
Waste management	Continued operation during the proposed SPEO term would generate additional waste which would need to be handled under the comprehensive regulatory controls that are in place. Therefore, the low public doses achieved at reactors to date ensure that the impacts to the environment would remain SMALL during the proposed SPEO term. Application of ALARA principles during the operating years of the proposed SPEO term would minimize increases in radioactivity in the structures and equipment to be decommissioned. The expected increase in volume of spent fuel can be safely stored onsite in either pool or dry storage. Additional pad(s) will be added to the existing ISFSI to accommodate the increased spent fuel volume. The expanded ISFSI would require decommissioning, but use of NRC-licensed dry storage modules would minimize radioactivity levels in the pads. Spent fuel will be stored in the ISFSI until transfer to a licensed facility. If spent nuclear fuel remains in storage after ONS's license termination, the ISFSI would remain under a new separate license and decommissioning of the ISFSI would be conducted under that separate ISFSI license following transfer to all the spent nuclear fuel to a licensed facility.

Given Duke Energy's radiation protection and radioactive waste management programs and no appreciable changes in socioeconomic aspects of plant operation, Duke Energy finds that continued operations during a subsequent license renewal term would be a SMALL impact on terminating operations and decommissioning on all resources.

ALARA principles would continue to minimize increases in radioactivity in the structures and equipment to be decommissioned in a second renewal term as in a first. The current ISFSI at ONS is to be expanded in 2023 to increase storage capacity, and additional pads within the ISFSI site would be added as needed to accommodate SNF from an SPEO term (Duke 2022). The use of licensed storage casks minimizes direct radiation, minimizing increases in radioactivity in the ISFSI pads. Finally, as discussed above, tax payments would continue during the SPEO term, providing the relatively same beneficial impact as during the current license term.

Duke Energy finds that impacts from termination of plant operations and decommissioning for the proposed SPEO term would be SMALL.

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