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

NUREG–1437
Supplement 5a
Second Renewal

# Site-Specific Environmental Impact Statement for License Renewal of Nuclear Plants

## Supplement 5a, Second Renewal

## Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4

Draft Report for Comment

Office of Nuclear Material Safety and Safeguards

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## Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4

Draft Report for Comment

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# COVER SHEET

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# ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC, the Commission) staff prepared this site-specific environmental impact statement (EIS) to supplement the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (NUREG–1437, Supplement 5, Second Renewal) (FSEIS), issued in October 2019. This EIS includes the NRC staff's site-specific evaluation of the environmental impacts of subsequent license renewal (SLR) for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point) for each of the environmental issues that the FSEIS dispositioned as Category 1 issues (generic to all or a distinct subset of nuclear power plants) consistent with Table B–1 in Appendix B to Subpart A of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51 and NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (LR GEIS).

This EIS considers information contained in the Florida Power & Light Company (FPL) June 9, 2022, submittal (FPL 2022a), which supplements its 2018 SLR application that was considered in the FSEIS. The EIS also considers whether there is significant new information that would change the NRC staff's conclusions concerning Category 2 issues (specific to individual nuclear power plants) in the FSEIS. The NRC staff prepared the EIS in accordance with the Commission's decisions in Commission Legal Issuance (CLI)-22-02 and CLI-22-03, both dated February 24, 2022. These decisions, confirmed in CLI-22-06 issued on June 3, 2022, directed the NRC staff to modify the expiration dates of the Turkey Point subsequent renewed licenses, which were issued on December 4, 2019, to reflect the end dates of the previous renewed licenses (i.e., July 19, 2032, for Turkey Point Unit 3 and April 10, 2033, for Turkey Point Unit 4). Together, this EIS and the previous FSEIS evaluate, on a site-specific basis, all of the environmental impacts of continued operation during the SLR term for Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and for Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

Based on the October 2019 FSEIS and the NRC staff's evaluation in this EIS, the staff's preliminary recommendation is that the adverse environmental impacts of SLR for Turkey Point

(i.e., the continued operation of Turkey Point for a period of 20 years beyond the expiration dates of the initial renewed licenses) are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. The NRC staff based its recommendation on the following:

- FPL's environmental report, as supplemented
- the NRC staff's consultations with Federal, State, Tribal, and local government agencies
- the NRC staff's independent environmental review, which is documented in the FSEIS and this EIS
- the NRC staff's consideration of public comments.

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# EXECUTIVE SUMMARY

By letter dated January 30, 2018, Florida Power & Light Company (FPL, the licensee) submitted to the U.S. Nuclear Regulatory Commission (NRC, the Commission) an application requesting subsequent license renewal (SLR) of the Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point, Turkey Point Units 3 and 4) renewed facility operating licenses (FPL 2018a). FPL subsequently supplemented its SLR application by letters dated February 9, 2018 (FPL 2018b), February 16, 2018 (FPL 2018c), March 1, 2018 (FPL 2018d), and April 10, 2018 (FPL 2018e). The Turkey Point Unit 3 initial renewed facility operating license (DPR-31) was set to expire at midnight on July 19, 2032, and the Turkey Point Unit 4 initial renewed facility operating license (DPR-41) was set to expire at midnight on April 10, 2033. In its SLR application, FPL requested subsequent renewed facility operating licenses for a period of 20 years beyond these expiration dates—i.e., July 19, 2052, for Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4.

The NRC's environmental protection regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," implement the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4321 et seq.), and require, in part, that the NRC prepare an environmental impact statement (EIS) before the issuance or renewal of a license to operate a nuclear power plant. Pursuant to these regulations, the NRC staff performed an environmental review of FPL's SLR application as a supplement to NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (LR GEIS) (NRC 2013a). Specifically, in March 2019, the NRC staff issued a draft supplement to the LR GEIS, titled "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Draft Report for Comment" (NRC 2019a). In October 2019, after considering public comments on the draft supplement, the NRC staff issued a final supplement to the LR GEIS, titled "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (FSEIS) (NRC 2019b). The FSEIS concluded, in part, that the adverse environmental impacts of SLR for Turkey Point are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. Based, in part, on that environmental review, on December 4, 2019, the NRC issued subsequent renewed licenses for Turkey Point (NRC 2019b), with expiration dates of July 19, 2052, for Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4.

On February 24, 2022, the Commission issued three memoranda and orders that addressed the NRC staff's environmental reviews in SLR proceedings for five nuclear power plants. Two of these orders, Commission Legal Issuance (CLI)-22-02 (NRC 2022a) and CLI-22-03 (NRC 2022b), addressed Turkey Point. In the orders, the Commission concluded that the LR GEIS, on which the NRC staff had relied, in part, to meet its obligations under 10 CFR Part 51 and NEPA for its environmental reviews of the SLR applications for the affected nuclear power plants, did not consider SLR. Therefore, the Commission determined that the staff's SLR environmental reviews, including the environmental review for the Turkey Point SLR application, were inadequate. Accordingly, the Commission directed the NRC staff to modify the expiration dates of the Turkey Point subsequent renewed licenses to reflect the end dates of the previous renewed licenses (i.e., July 19, 2032, for Turkey Point Unit 3 and April 10, 2033, for Turkey Point Unit 4). The Commission affirmed this direction in CLI-22-06 (NRC 2022c).

In CLI-22-03, the Commission directed the NRC staff to update the LR GEIS so that it covers nuclear power plant operation during the SLR period. The Commission stated that it believed the most efficient way to proceed would be for the NRC staff to update the LR GEIS and then take appropriate action with respect to pending SLR applications to ensure that the environmental impacts for the period of SLR are considered. Alternatively, the Commission allowed SLR applicants to submit a revised environmental report (ER) providing additional information about environmental impacts during the SLR period, in which they evaluate, on a site-specific basis, the environmental impacts that were dispositioned in Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 and the LR GEIS as Category 1 issues (generic to all or a distinct subset of nuclear power plants). For SLR applicants that provide such information, the NRC staff was directed to address the environmental impacts of these issues in site-specific EISs.

Consistent with CLI-22-03, on June 9, 2022, FPL submitted ER Supplement 2, providing a site-specific analysis of the environmental impacts of the continued operation of Turkey Point during the SLR period (FPL 2022a). That analysis supplemented the ER (including ER Supplement 1) that was included as part of FPL's SLR application and addressed, on a site-specific basis, each environmental issue that was previously dispositioned as a Category 1 issue in the ER.

The NRC staff has prepared this EIS to evaluate, on a site-specific basis, the environmental impacts of the operation of Turkey Point during the SLR period for each of the environmental issues that were dispositioned as Category 1 issues in the FSEIS, in accordance with CLI-22-02 and CLI-22-03. The EIS considers information contained in the ER Supplement 2; the NRC staff's consultation with Federal, State, Tribal, and local government agencies; and other information, as appropriate. The EIS also considers whether there is significant new information that would change the NRC staff's conclusions concerning Category 2 issues (specific to individual nuclear power plants) evaluated in the FSEIS. Thus, the EIS supplements the FSEIS evaluation of Category 1 impacts and updates the FSEIS evaluation of Category 2 impacts, as set forth herein. Together, the EIS and the FSEIS evaluate, on a site-specific basis, all of the environmental impacts of continued operation during the SLR term for Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and for Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

## Proposed Federal Action

FPL initiated the proposed Federal action of determining whether to issue subsequent renewed licenses for Turkey Point by submitting an SLR application to the NRC. The Turkey Point Unit 3 initial renewed license was set to expire at midnight on July 19, 2032, and the Turkey Point Unit 4 initial renewed license was set to expire at midnight on April 10, 2033. On December 4, 2019, the NRC issued subsequent renewed licenses for Turkey Point authorizing operation for a period of 20 years beyond the expiration dates—i.e., July 19, 2052, for Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4. On March 25, 2022 (NRC 2022e), in accordance with the Commission's direction in CLI-22-02, dated February 24, 2022, the NRC staff modified the expiration dates of these subsequent renewed licenses to reflect the end dates of the previous renewed licenses. Therefore, the subsequent renewed licenses for Turkey Point now expire on July 19, 2032 (Unit 3) and April 10, 2033 (Unit 4).

The proposed Federal action as stated in the FSEIS (p. 1-1) is determining whether to issue subsequent renewed licenses for Turkey Point for an additional 20 years of operation. After issuing the FSEIS, the NRC issued (and later modified) subsequent renewed licenses for Turkey Point. Based on the above discussion, the proposed Federal action at this time is to

determine whether the site-specific evaluation presented in the EIS warrants any modification to the NRC staff's previous determination that the adverse environmental impacts of SLR for Turkey Point are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable.

## Purpose and Need for the Proposed Federal Action

The purpose and need for the proposed Federal action, as stated in the FSEIS (p. 1-1), is to provide an option that allows for power generation capability beyond the term of the current nuclear power plant licenses to meet future system generating needs. Such needs may be determined by energy-planning decision-makers, such as State regulators, utility owners, and Federal agencies other than the NRC. This definition of purpose and need reflects the NRC's recognition that, unless there are findings in the NRC's safety review (required by the Atomic Energy Act of 1954, as amended; 42 U.S.C. § 2011 et seq.) or findings in the NRC's environmental analysis (required by NEPA) that would lead the NRC to reject an SLR application, the NRC does not have a role in energy-planning decisions about whether a particular nuclear power plant should continue to operate.

## Environmental Impacts of the Proposed Federal Action

This EIS supplements the FSEIS in order to evaluate the potential environmental impacts of the proposed Federal action. The NRC designates these environmental impacts as SMALL, MODERATE, or LARGE.

**SMALL:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

**MODERATE:** Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

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

In this EIS, the NRC staff evaluates the environmental issues that were dispositioned as Category 1 issues in the FSEIS by reference to Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 and the LR GEIS. In the FSEIS, the NRC staff relied upon the analyses and conclusions in the LR GEIS for each of these issues, and considered any new and significant information that might change those conclusions. The NRC staff determined that there would be no impacts related to these issues beyond those already discussed in the LR GEIS; therefore, for each of these issues, the staff adopted the LR GEIS's conclusions of SMALL environmental impacts. However, as explained herein, the Commission later determined that the NRC staff cannot rely on the LR GEIS for the environmental reviews of SLR applications. Therefore, in this EIS, the NRC staff addresses each of these environmental issues on a site-specific basis. Table ES-1 lists these environmental issues and the NRC staff's site-specific conclusions related to the issues.

In the FSEIS, the NRC staff also evaluated additional environmental issues for the Turkey Point SLR application on a site-specific basis. Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 and the LR GEIS disposition these issues as site-specific or Category 2 issues. In this EIS, the NRC staff has identified no significant new information that would change the conclusions for these issues reached in the FSEIS. Therefore, the analyses and conclusions in the FSEIS

remain valid for these issues. Table ES-2 lists these environmental issues and the FSEIS's conclusions related to these issues.

In sum, this EIS supplements the FSEIS evaluation of Category 1 impacts and updates the FSEIS evaluation of Category 2 impacts and, together, the EIS and the FSEIS evaluate, on a site-specific basis, all of the potential environmental impacts of the proposed Federal action.

**Table ES-1 Summary of the Site-Specific Conclusions Regarding Turkey Point SLR Made in this EIS**

| Resource Area | Environmental Issue | Impacts |
|---|---|---|
| Land Use | Onsite land use | SMALL |
| Land Use | Offsite land use | SMALL |
| Land Use | Offsite land use in transmission line rights-of-way (ROWs) | SMALL |
| Visual Resources | Aesthetic impacts | SMALL |
| Air Quality | Air quality impacts | SMALL |
| Air Quality | Air quality effects of transmission lines | SMALL |
| Noise | Noise impacts | SMALL |
| Geologic Environment | Geology and soils | SMALL |
| Surface Water Resources | Surface water use and quality (non-cooling system impacts) | SMALL |
| Surface Water Resources | Discharge of metals in cooling system effluent | SMALL |
| Surface Water Resources | Discharge of biocides, sanitary wastes, and minor chemical spills | SMALL |
| Surface Water Resources | Effects of dredging on surface water quality | SMALL |
| Groundwater Resources | Groundwater contamination and use (non-cooling system impacts) | SMALL |
| Groundwater Resources | Groundwater quality degradation resulting from water withdrawals | SMALL |
| Groundwater Resources | Groundwater quality degradation (plants with cooling ponds in salt marshes) | SMALL to MODERATE |
| Groundwater Resources | Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) | SMALL to MODERATE |
| Terrestrial Resources | Exposure of terrestrial organisms to radionuclides | SMALL |
| Terrestrial Resources | Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) | SMALL |
| Terrestrial Resources | Bird collisions with plant structures and transmission lines | SMALL |
| Terrestrial Resources | Transmission line right-of-way management impacts on terrestrial resources[(c)] | SMALL |
| Terrestrial Resources | Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) | SMALL |
| Aquatic Resources | Entrainment of phytoplankton and zooplankton | SMALL |
| Aquatic Resources | Infrequently reported thermal impacts | SMALL |
| Aquatic Resources | Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication | SMALL |
| Aquatic Resources | Effects of nonradiological contaminants on aquatic organisms | SMALL |
| Aquatic Resources | Exposure of aquatic organisms to radionuclides | SMALL |

**Table ES-1 Summary of the Site-Specific Conclusions Regarding Turkey Point SLR Made in this EIS (Continued)**

| Resource Area | Environmental Issue | Impacts |
|---|---|---|
| Aquatic Resources | Effects of dredging on aquatic organisms | SMALL |
| Aquatic Resources | Effects on aquatic resources (non-cooling system impacts) | SMALL |
| Aquatic Resources | Impacts of transmission line right-of-way management on aquatic resources[(c)] | SMALL |
| Aquatic Resources | Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses | SMALL |
| Socioeconomics | Employment and income, recreation and tourism | SMALL |
| Socioeconomics | Tax revenues | SMALL |
| Socioeconomics | Community services and education | SMALL |
| Socioeconomics | Population and housing | SMALL |
| Socioeconomics | Transportation | SMALL |
| Human Health | Radiation exposures to the public | SMALL |
| Human Health | Radiation exposures to plant workers | SMALL |
| Human Health | Human health impact from chemicals | SMALL |
| Human Health | Microbiological hazards to plant workers | SMALL |
| Human Health | Physical occupational hazards | SMALL |
| Postulated Accidents | Design basis accidents | SMALL |
| Postulated Accidents | Severe accidents | Probability-weighted consequences of severe accidents are SMALL |
| Waste Management | Low-level waste storage and disposal | SMALL |
| Waste Management | Onsite storage of spent nuclear fuel | SMALL |
| Waste Management | Offsite radiological impacts of spent nuclear fuel and high-level waste disposal | [(a)] |
| Waste Management | Mixed-waste storage and disposal | SMALL |
| Waste Management | Nonradioactive waste storage and disposal | SMALL |
| Uranium Fuel Cycle | Offsite radiological impacts—individual impacts from sources other than the disposal of spent fuel and high-level waste | SMALL |
| Uranium Fuel Cycle | Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste | [(b)] |
| Uranium Fuel Cycle | Nonradiological impacts of the uranium fuel cycle | SMALL |
| Uranium Fuel Cycle | Transportation | SMALL |
| Termination of Nuclear Power Plant Operations and Decommissioning | Termination of plant operations and decommissioning | SMALL |

(a) The ultimate disposal of spent nuclear fuel and high-level waste in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this site-specific review. The environmental impact of this issue for the time frame beyond the licensed life for reactor operations is contained in NUREG–2157, the NRC's "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel." Per 10 CFR Part 51 Subpart A, the Commission determined that the impacts presented in NUREG–2157 would not be sufficiently large to require the conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level

**Table ES-1 Summary of the Site-Specific Conclusions Regarding Turkey Point SLR Made in this EIS (Continued)**

| Resource Area | Environmental Issue | Impacts |
|---|---|---|

of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants and does not warrant a site-specific analysis.

(b) There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission determined that the collective impacts are acceptable. The Commission also determined that the impacts would not be sufficiently large to require the conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered generic to all nuclear power plants and does not warrant a site-specific analysis.

(c) This issue applies only to the in-scope portion of electric power transmission lines, which are defined as transmission lines that connect the nuclear power plant to the substation where electricity is fed into the regional power distribution system and transmission lines that supply power to the nuclear power plant from the grid.

**Table ES-2 Summary of the Site-Specific Conclusions Regarding Turkey Point SLR Made in the FSEIS**

| Resource Area | Environmental Issue | Impacts[a] |
|---|---|---|
| Groundwater Resources | Groundwater use conflicts (plants that withdraw more than 100 gallons per minute [gpm]) | SMALL to MODERATE |
| Groundwater Resources | Radionuclides released to groundwater | SMALL |
| Terrestrial Resources | Effects on terrestrial resources (non-cooling system impacts) | SMALL |
| Aquatic Resources | Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) | SMALL to MODERATE[b] |
| Aquatic Resources | Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) | SMALL to MODERATE[b] |
| Special Status Species and Habitats | Threatened, endangered, and protected species and essential fish habitat | Impact determinations vary by species and habitat[c] |
| Historic and Cultural Resources | Historic and cultural resources | Would not adversely affect known historic properties or historic and cultural resources[d] |
| Human Health | Chronic effects of electromagnetic fields | Uncertain Impact |
| Human Health | Electric shock hazards[e] | SMALL |
| Environmental Justice | Minority and low-income populations | No disproportionately high and adverse human health and environmental effects |
| Cumulative Impacts | Cumulative impacts | See FSEIS Section 4.16 |

(a) In reciting the FSEIS conclusions here, the NRC staff notes that the impact determinations for these issues were described in Chapter 4 of the FSEIS.

(b) The NRC staff notes that the FSEIS conclusion of “SMALL to MODERATE” applied to aquatic resources in the cooling canal system. Aquatic organisms inhabiting Biscayne Bay and connected water bodies (e.g., Card Sound, the Atlantic Ocean) are not subject to impingement and entrainment because they do not interact with the Turkey Point intake structure, and there are no thermal effects outside the cooling canal system because there are no surface water connections that allow flow between the waters of Biscayne Bay and the cooling canal system.

**Table ES-2 Summary of the Site-Specific Conclusions Regarding Turkey Point SLR Made in the FSEIS (Continued)**

| Resource Area | Environmental Issue | Impacts[(a)] |
|---|---|---|

(c) In the FSEIS, the NRC staff concluded that Turkey Point SLR is likely to adversely affect the American crocodile and the eastern indigo snake and may result in adverse modification of the designated critical habitat of the American crocodile. The FSEIS also concluded that the proposed action may affect but is not likely to adversely affect the Florida panther, West Indian manatee, red knot, wood stork, loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, and smalltooth sawfish. The FSEIS further concluded that the proposed action would result in no adverse modification of designated critical habitat of the West Indian manatee. The NRC staff's evaluation of impacts on federally listed species and critical habitats under the U.S. Fish and Wildlife Service's (FWS) jurisdiction appears in the NRC's Biological Assessment (NRC 2018). The FWS's separate evaluation and conclusions appear in a July 25, 2019, biological opinion (FWS 2019), which is described in Section 4.8.1.1 of the FSEIS. The FWS later amended its biological opinion on March 21, 2022 (FWS 2022). The NRC staff's evaluation of impacts on federally listed species and critical habitats under the National Marine Fisheries Service's jurisdiction appears in Section 4.8.1.1 of the FSEIS. The FSEIS concluded that the proposed action would have no adverse effects on essential fish habitat. The NRC staff's evaluation of impacts on essential fish habitat appears in Section 4.8.1.2 of the FSEIS. The NRC staff also concluded in the FSEIS that the proposed action would not affect the sanctuary resources of the Florida Keys National Marine Sanctuary. The NRC staff's evaluation of sanctuary resources appears in Section 4.8.1.3 of the FSEIS.

(d) The NRC staff notes that, based on (1) the location of National Register of Historic Places-eligible historic properties within the area of potential effect, (2) Tribal input, (3) FPL's cultural resource protection plans, (4) the fact that no license renewal-related physical changes or ground-disturbing activities would occur, (5) Florida State Historic Preservation Office input, and (6) cultural resource assessment, the FSEIS concluded that Turkey Point SLR would not adversely affect any known historic properties. See FSEIS Table 2-2.

(e) The NRC staff notes that this issue applies only to the in-scope portion of electric power transmission lines, which are defined as transmission lines that connect the nuclear power plant to the substation where electricity is fed into the regional power distribution system and transmission lines that supply power to the nuclear power plant from the grid.

## Alternatives

As part of its environmental review, the NRC is required to consider reasonable alternatives to SLR and to evaluate the environmental impacts associated with each alternative. These alternatives can include other methods of power generation (replacement power alternatives), as well as not authorizing the operation of Turkey Point for an additional 20 years (the no-action alternative).

In the FSEIS, the NRC staff initially considered 16 replacement power alternatives but later dismissed 13 of them because of technical, resource availability, or commercial limitations that existed at that time, and that the NRC staff believed are likely to still exist when the Turkey Point licenses expire. This left the following three feasible and commercially viable replacement power alternatives:

- new nuclear power
- new natural gas combined-cycle power
- a combination of new natural gas combined-cycle power and new solar photovoltaic power.

The NRC staff evaluated these alternatives, along with the no-action alternative, in depth in Chapter 4 of the FSEIS. Additionally, the staff evaluated an alternative cooling water system to mitigate potential impacts associated with the continued use of the existing cooling canal system. Finally, Appendix F of the FSEIS evaluated any new and significant information that could alter the conclusions of the severe accident mitigation alternatives (SAMA) analysis that was performed previously in connection with the initial license renewal for Turkey Point. In

developing this EIS, the NRC staff has identified no significant new information that would change these discussions in the FSEIS.

## Recommendation

The NRC staff's recommendation in the FSEIS was that the adverse environmental impacts of Turkey Point SLR are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. The NRC staff based this recommendation on the LR GEIS, as well as the following:

- FPL's ER
- the NRC staff's consultation with Federal, State, Tribal, and local government agencies
- the NRC staff's independent environmental review documented in the FSEIS
- the NRC staff's consideration of public comments.

The NRC staff's preliminary recommendation in this EIS is that the adverse environmental impacts of SLR for Turkey Point (i.e., the continued operation of Turkey Point for a period of 20 years beyond the expiration dates of the initial renewed licenses) are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. In this EIS, the NRC staff considers each of the sources listed above that were considered in the FSEIS, other than the LR GEIS. In addition, the NRC staff considers additional information provided by those sources following the issuance of the FSEIS, including information concerning the site-specific impacts of issues that were previously treated as Category 1 impacts and any significant new information that would change the conclusions reached in the FSEIS regarding Category 2 impacts.

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| § | Section |
| ac | acre(s) |
| ADAMS | Agencywide Documents Access and Management System |
| AEA | Atomic Energy Act of 1954, as amended |
| ALARA | as low as is reasonably achievable |
| ANS | Aquatic Nuisance Species |
| APLIC | Avian Power Line Interaction Committee |
| APP | Avian Protection Plan |
| BMP | best management practice |
| CCS | cooling canal system |
| CFR | *Code of Federal Regulations* |
| CLB | current licensing basis |
| CLI | Commission Legal Issuance |
| CO | carbon monoxide |
| CSEM | continuous surface electromagnetic mapping |
| CWA | Clean Water Act |
| CZMA | Coastal Zone Management Act |
| dBA | A-weighted decibel(s) |
| DOE | U.S. Department of Energy |
| ECFASV2 | East Coast Floridan Aquifer System version 2 |
| EIS | environmental impact statement |
| ELU | existing legal users |
| EMF | electromagnetic field |
| EPA | U.S. Environmental Protection Agency |
| ER | environmental report |
| FDEP | Florida Department of Environmental Protection |
| FDOH | Florida Department of Health |
| FPL | Florida Power & Light Company |
| FR | *Federal Register* |
| FRN | *Federal Register* notice |
| FSEIS | final supplemental environmental impact statement or “Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4” (NUREG–1437) |
| fps | feet per second |

| | |
|---|---|
| ft | foot (feet) |
| FWS | U.S. Fish and Wildlife Service |
| GEIS | generic environmental impact statement |
| gpm | gallon(s) per minute |
| ha | hectare(s) |
| IAEA | International Atomic Energy Agency |
| ICRP | International Commission on Radiation Protection |
| in. | inch(es) |
| ISFSI | Independent spent fuel storage installation |
| IWW | industrial wastewater |
| kV | kilovolt(s) |
| L | liter(s) |
| LLD | lower limit of detection |
| LR GEIS | license renewal generic environmental impact statement or "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (NUREG–1437) |
| LOS | level of service |
| LWR | light-water reactor |
| m | meter(s) |
| MDC | Miami-Dade County |
| MDWSD | Miami-Dade Water and Sewer Department |
| MEI | maximally exposed individual |
| mg | milligram(s) |
| MG | million gallons |
| MGD | million gallons per day |
| MGY | million gallons per year |
| mm | millimeter(s) |
| m/s | meters per second |
| $m^3/s$ | cubic meters per second |
| NCRP | National Council on Radiation Protection and Measurements |
| NEPA | National Environmental Policy Act of 1969, as amended |
| NMFS | National Marine Fisheries Service |
| NMSS | Nuclear Material Safety and Safeguards |
| $NO_2$ | nitrogen dioxide |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | U.S. Nuclear Regulatory Commission |
| ODCM | Offsite Dose Calculation Manual |
| OSHA | Occupational Safety and Health Administration |

| | |
|---|---|
| PILOT | payments in lieu of tax |
| PM | particulate matter |
| PRA | Probabilistic Risk Assessment |
| psu | practical salinity unit |
| PW | permitted well |
| RAI | Request for Additional Information |
| RCI | Request for Confirmatory Information |
| RCRA | Resource Conservation and Recovery Act of 1976, as amended |
| REMP | Radiological Environmental Monitoring Program |
| Rn | radon |
| ROW | right-of-way |
| RW | recovery well |
| RWS | Recovery Well System |
| SAMA | severe accident mitigation alternative |
| SEIS | supplemental environmental impact statement |
| SFWMD | South Florida Water Management District |
| SLR | subsequent license renewal |
| $SO_2$ | sulfur dioxide |
| SPCC | spill prevention, control, and countermeasure |
| SWPPP | stormwater pollution prevention plan |
| Tc | technetium |
| TDS | total dissolved solids |
| TEDE | total effective dose equivalent |
| Turkey Point | Turkey Point Nuclear Generating Unit Nos. 3 and 4 |
| UFA | Upper Floridan Aquifer |
| UIC | Underground Injection Control |
| UNSCEAR | United Nations Scientific Committee on the Effects of Atomic Radiation |
| U.S. | United States |
| USACE | U.S. Army Corps of Engineers |
| U.S.C. | *United States Code* |
| USCB | U.S. Census Bureau |
| VOC | volatile organic compound |

# 1 INTRODUCTION

The U.S. Nuclear Regulatory Commission's (NRC's, the Commission's) environmental protection regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," implement the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4321 et seq.), and require, in part, that the NRC prepare an environmental impact statement (EIS) before the issuance or renewal of a license to operate a nuclear power plant.

The Atomic Energy Act of 1954, as amended (AEA; 42 U.S.C. 2011 et seq.), specifies that licenses for commercial nuclear power plants can be granted for up to 40 years. The initial 40-year licensing period was based on economic and antitrust considerations rather than on technical limitations of the nuclear facility. NRC regulations permit these licenses to be renewed beyond the initial 40-year term for an additional period, limited to 20-year increments per renewal. Renewal is based on the results of (1) the NRC staff's environmental review and (2) the NRC staff's safety review (10 CFR 54.29, "Standards for issuance of a renewed license"). Neither the AEA nor the NRC's regulations restrict the number of times a license may be renewed. The decision to seek renewal rests entirely with nuclear power plant owners and typically is based on the plant's economic viability and the investment necessary to continue to meet all safety and environmental requirements. The NRC makes the decision to grant or deny license renewal based on whether the applicant has demonstrated reasonable assurance that it can meet the environmental and safety requirements in the agency's regulations during the period of extended operation.

Pursuant to 10 CFR Part 51, the NRC staff performed an environmental review of the Florida Power & Light Company (FPL, the licensee) January 30, 2018, subsequent license renewal (SLR) application, as supplemented by letters dated February 9, 2018 (FPL 2018b), February 16, 2018 (FPL 2018c), March 1, 2018 (FPL 2018d), and April 10, 2018 (FPL 2018fe. In its SLR application, FPL requested subsequent renewed facility operating licenses for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point, Turkey Point Units 3 and 4) for a period of 20 years beyond the dates when the initial renewed facility operating licenses would expire—i.e., July 19, 2052, for Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4. As part of its SLR application, FPL submitted an environmental report (ER) (FPL 2018f), which it supplemented by letter dated April 10, 2018 (ER Supplement 1) (FPL 2018e).

The NRC staff documented its environmental review of FPL's SLR application as a supplement to NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (LR GEIS; NRC 2013a). Specifically, in March 2019, the NRC staff issued a draft supplement to the LR GEIS, titled "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Draft Report for Comment" (NRC 2019). In October 2019, after considering public comments on the draft supplement, the NRC staff issued a final supplement to the LR GEIS, titled "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (FSEIS) (NRC 2019a). The FSEIS concluded, in part, that the adverse environmental impacts of SLR for Turkey Point are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. Based, in part, on that environmental review, on December 4, 2019, the NRC issued subsequent renewed licenses for Turkey Point (NRC 2019b), which included the expiration dates of July 19, 2052, for

Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4. In accordance with 10 CFR Part 51, the NRC also issued a record of decision in support of this action (NRC 2019c).

On February 24, 2022, the Commission issued three memoranda and orders that addressed the NRC staff's environmental reviews in SLR proceedings for five nuclear power plants (NRC 2022a, 2022b, 2022d). Two of these orders, Commission Legal Issuance (CLI)-22-02 (NRC 2022a) and CLI-22-03 (NRC 2022b), addressed Turkey Point. In the orders, the Commission concluded that the LR GEIS, on which the NRC staff had relied, in part, to meet its obligations under 10 CFR Part 51 and NEPA for its environmental reviews of the SLR applications for the affected nuclear power plants, did not consider SLR. Therefore, the Commission determined that the staff's SLR environmental reviews, including the environmental review for the Turkey Point SLR application, were inadequate. Accordingly, the Commission directed the NRC staff to leave the Turkey Point subsequent renewed licenses in place but to modify their expiration dates to reflect the end dates of the previous renewed licenses (i.e., July 19, 2032, for Turkey Point Unit 3 and April 10, 2033, for Turkey Point Unit 4), which the staff did on March 25, 2022 (NRC 2022e). The Commission affirmed this direction in CLI-22-06 (NRC 2022c).

In CLI-22-03, the Commission directed the NRC staff to update the LR GEIS so that it covers nuclear power plant operation during the SLR period (NRC 2022b). The Commission stated that it believed the most efficient way to proceed would be for the NRC staff to update the LR GEIS and then take appropriate action with respect to pending SLR applications to ensure that the environmental impacts for the period of SLR are considered. Alternatively, the Commission allowed SLR applicants to submit a revised ER providing additional information about environmental impacts during the SLR period, in which they evaluate, on a site-specific basis, the environmental impacts that were dispositioned in Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 and the LR GEIS as Category 1 issues (generic to all or a distinct subset of nuclear power plants). For SLR applicants that provide such information, the NRC staff was directed to address the environmental impacts of these issues in site-specific EISs.

Consistent with CLI-22-03, on June 9, 2022, FPL submitted ER Supplement 2, providing a site-specific analysis of the environmental impacts of the continued operation of Turkey Point during the SLR period (FPL 2022a). That analysis supplemented the ER and ER Supplement 1 that were included as part of FPL's SLR application (FPL 2018f, 2018e) and addressed, on a site-specific basis, each environmental issue that was previously dispositioned as a Category 1 issue in the ER and ER Supplement 1.

## 1.1 Proposed Federal Action

FPL initiated the proposed Federal action of determining whether to issue subsequent renewed licenses for Turkey Point by submitting an SLR application to the NRC. The Turkey Point Unit 3 initial renewed license was set to expire at midnight on July 19, 2032, and the Turkey Point Unit 4 initial renewed license was set to expire at midnight on April 10, 2033. On December 4, 2019, the NRC issued subsequent renewed licenses for Turkey Point authorizing operation for a period of 20 years beyond the expiration dates—i.e., July 19, 2052, for Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4. On March 25, 2022 (NRC 2022e), in accordance with the Commission's direction in CLI-22-02, dated February 24, 2022, the NRC staff modified the expiration dates of these subsequent renewed licenses to reflect the end dates of the previous renewed licenses. Therefore, the subsequent renewed licenses for Turkey Point now expire on July 19, 2032 (Unit 3) and April 10, 2033 (Unit 4).

The proposed Federal action as stated in the FSEIS (p. 1-1) is to determine whether to issue subsequent renewed licenses for Turkey Point for an additional 20 years of operation. After issuing the FSEIS, the NRC issued (and later modified) subsequent renewed licenses for Turkey Point. Based on the above discussion, the proposed Federal action at this time is to determine whether the site-specific evaluation presented in the EIS warrants any modification to the NRC staff's previous determination that the adverse environmental impacts of SLR for Turkey Point are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable.

## 1.2 Purpose and Need for the Proposed Federal Action

The purpose and need for the proposed Federal action, as stated in the FSEIS (p. 1-1), is to provide an option that allows for power generation capability beyond the term of the current nuclear power plant licenses to meet future system generating needs. Such needs may be determined by energy-planning decision-makers, such as State regulators, utility owners, and Federal agencies other than the NRC. This definition of purpose and need reflects the NRC's recognition that, unless there are findings in the NRC's safety review (required by the Atomic Energy Act of 1954, as amended) or findings in the NRC's environmental analysis (required by NEPA) that would lead the NRC to reject an SLR application, the NRC does not have a role in making energy-planning decisions about whether a particular nuclear power plant should continue to operate.

## 1.3 Major Environmental Review Milestones

By letter dated June 9, 2022, FPL submitted to the NRC its ER Supplement 2 (FPL 2022a). On July 26, 2022, the NRC issued a notice of its receipt of ER Supplement 2 (Volume 87 of the *Federal Register* (FR), page 44430 [87 FR 44430]). On October 7, 2022, the NRC issued a notice of its intent to prepare an EIS supplement and to conduct EIS scoping (87 FR 61104).

To independently verify the information that FPL provided in ER Supplement 2, the NRC staff conducted a virtual audit in December 2022 and January 2023. In a letter dated February 1, 2023, the staff summarized the audit and listed the attendees (NRC 2023). During the audit, the staff held meetings with Turkey Point plant personnel and reviewed site-specific documentation.

The NRC has established a license renewal process that includes clear requirements to assure safe plant operation for up to an additional 20 years of plant life. This process consists of separate environmental and safety reviews, which the NRC staff conducts simultaneously and documents in two reports: (1) the EIS documents the environmental review and (2) the safety evaluation report (SER) documents the safety review. The staff's findings in the EIS and the SER are both factors in the NRC's decision to grant or deny the issuance of a renewed license. The environmental review process specific to this EIS is illustrated below in Figure 1-1.

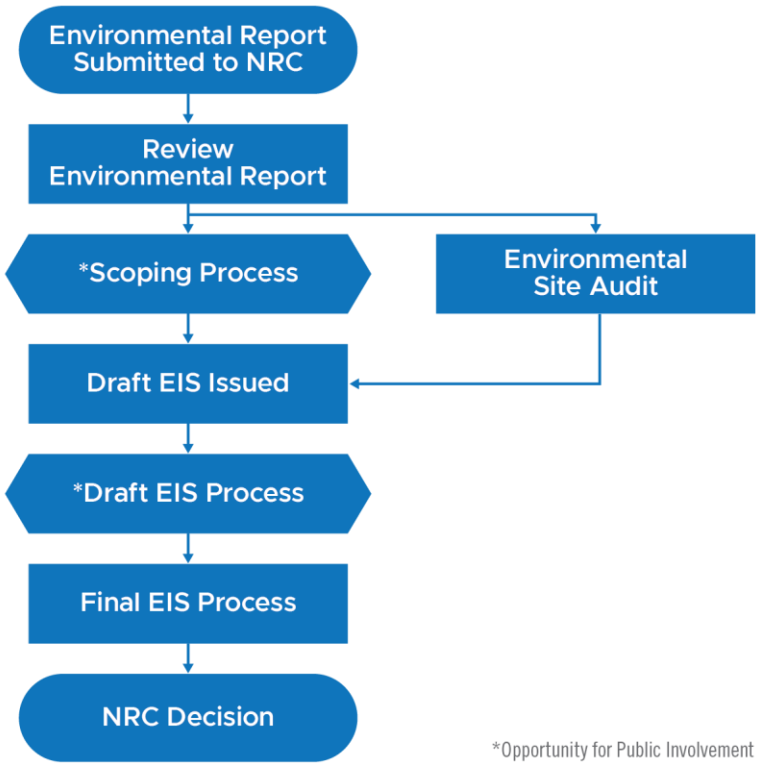


**Figure 1-1 Environmental Review Process**

## 1.4 Environmental Impacts of the Proposed Federal Action

This EIS supplements the FSEIS in order to evaluate the potential environmental impacts of the proposed Federal action. The NRC designates these environmental impacts as SMALL, MODERATE, or LARGE.

**SMALL:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

**MODERATE:** Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

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

The NRC staff has prepared this EIS to evaluate, on a site-specific basis, the environmental impacts of the operation of Turkey Point during the SLR period for each of the environmental issues that were dispositioned as Category 1 issues in the FSEIS, in accordance with CLI-22-02 and CLI-22-03. The EIS considers information contained in ER Supplement 2; the NRC staff's consultation with Federal, State, Tribal, and local government agencies; and other information, as appropriate. The EIS also considers whether there is significant new information that would change the NRC staff's conclusions concerning Category 2 issues (specific to individual nuclear power plants) in the FSEIS. Thus, the EIS supplements the FSEIS evaluation of Category 1 impacts and updates the FSEIS evaluation of Category 2 impacts, as set forth herein. Together, the EIS and the FSEIS evaluate, on a site-specific basis, all of the environmental impacts of

continued operation during the SLR term for Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and for Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

In the FSEIS, the NRC staff relied upon the analyses and conclusions in the LR GEIS for each of the environmental issues that were dispositioned as Category 1 issues in the LR GEIS and Table B–1 in Appendix B to Subpart A of 10 CFR Part 51. In the FSEIS, the NRC staff also considered any new and significant information that might change those conclusions. The NRC staff determined in the FSEIS that there would be no impacts related to these issues beyond those already discussed in the LR GEIS; therefore, for each of these issues, the FSEIS adopted the LR GEIS's conclusions of SMALL environmental impacts. However, as explained herein, the Commission later determined that the NRC staff cannot rely on the LR GEIS for the environmental reviews of SLR applications (NRC 2022a, NRC 2022b). Therefore, in this EIS, the NRC staff addresses each of these environmental issues on a site-specific basis.

In the FSEIS, the NRC staff also evaluated an additional set of environmental issues for the Turkey Point SLR application on a site-specific basis. Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 and the LR GEIS disposition these issues as Category 2 issues that are specific to individual nuclear power plants. The FSEIS's analyses of these issues are unaffected by the Commission orders because the NRC staff already performed site-specific analyses of these issues for Turkey Point SLR. This EIS incorporates by reference the FSEIS conclusions for these issues, as appropriate, and considers whether there is any significant new information that would change the NRC staff's FSEIS conclusions concerning the issues.

In sum, this EIS supplements the FSEIS evaluation of Category 1 impacts and updates the FSEIS evaluation of Category 2 impacts and, together, the EIS and the FSEIS evaluate, on a site-specific basis, all of the potential environmental impacts of the proposed Federal action.

## 1.5 Site-Specific Environmental Impact Statement

This site-specific EIS presents the NRC staff's supplemental analysis of the environmental effects of the continued operation of Turkey Point during the SLR term, reasonable alternatives to SLR, and mitigation measures for minimizing adverse environmental impacts. Chapter 2, "Environmental Consequences and Mitigating Actions," contains an analysis and comparison of the potential environmental impacts from SLR and alternatives to SLR. Chapter 3, "Conclusion," presents the NRC staff's recommendation about whether the environmental impacts of SLR for Turkey Point are so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. In issuing this site-specific EIS, the NRC staff considered the comments it received during the public scoping comment period. The NRC staff will consider the public comments that it receives on this draft site-specific EIS and will then issue its final site-specific EIS. The NRC staff will make its final determination on SLR for Turkey Point Units 3 and 4 in a record of decision to be issued following issuance of the final site-specific EIS.

In the preparation of this site-specific EIS, the NRC staff carried out the following activities:

- reviewed the information provided in FPL's ER Supplement 2
- consulted with Federal, State, Tribal, and local government agencies
- conducted an independent environmental review, including the environmental and severe accident mitigation alternatives analysis site audits
- considered public comments received during the scoping process.

New information can come from many sources, including the applicant, the NRC, other agencies, or public comments. If the information revealed a new issue, the staff analyzed the issue to determine whether it was within the scope of the license renewal environmental evaluation. If the staff determined that the new issue was relevant to the proposed action, the staff then determined the significance of the issue for the plant and analyzed the issue in the EIS, as appropriate.

## 1.6 Decisions to Be Supported by the EIS

This site-specific EIS provides information and analyses to support an NRC decision about whether the environmental impacts of SLR for Turkey Point are so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable.

The NRC takes many factors into consideration when making a final decision about SLR for a nuclear power plant. The analyses of environmental impacts in this site-specific EIS will provide the NRC with important environmental information for use in the overall decision-making process related to SLR for Turkey Point. Other decisions are made outside the regulatory scope of SLR, by the NRC or other decision-makers, as appropriate. These include decisions related to (1) changes in plant cooling systems, (2) disposition of spent nuclear fuel, (3) emergency preparedness, (4) safeguards and security, (5) need for power, and (6) seismicity and flooding (NRC 2013a).

## 1.7 Cooperating Agencies

The U.S. National Park Service, Southeast Region (NPS), is participating in this environmental review as a cooperating agency. The NPS does not have any specific regulatory actions related to Turkey Point SLR at this time; however, the NPS is providing special expertise for environmental issues pertaining to the areas in and around Biscayne National Park, which is located next to the Turkey Point site. The NPS also cooperated in the NRC staff's preparation of the site-specific EIS. The NRC and NPS staff met several times to discuss the proposed action and its effects, and the NPS reviewed and provided comments on preliminary sections of the draft EIS discussing surface water and groundwater resources.

## 1.8 Consultations

Certain Federal environmental statutes require Federal agencies to consult with other agencies, Tribes, and organizations before taking an action that may affect protected environmental resources, such as endangered species, habitat of managed fisheries, and historical and cultural resources. These include the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.); the Magnuson-Stevens Fishery Conservation and Management Act of 1996, as amended (16 U.S.C. 1801 et seq.); and the National Historic Preservation Act of 1966, as amended (54 U.S.C. 300101 et seq.), among others.

In preparing the FSEIS, the NRC consulted with numerous agencies and Tribes. These consultations are summarized in Section 1.8 and Appendix C of the FSEIS. In preparing this site-specific EIS, the NRC staff consulted with the following agencies, organizations, and Tribes:

- Miami-Dade County Office of Historic Preservation
- Miccosukee Tribe of Indians of Florida
- Muscogee (Creek) Nation

- Poarch Band of Creek Indians
- The Seminole Nation of Oklahoma
- Seminole Tribe of Florida
- Florida Department of State, Division of Historical Resources
- Federal Advisory Council on Historic Preservation.

Appendix B, "Consultation Correspondence," of this EIS discusses the consultations that the NRC staff conducted, or considered to be unwarranted, in support of this EIS.

## 1.9 Correspondence

During the environmental review, the NRC staff contacted the Federal, State, regional, local, and Tribal government agencies listed in Section 1.8 above. Appendix B, "Consultation Correspondence," describes correspondence between the NRC staff, other Federal agencies, and Tribes. Appendix C, "Chronology of Environmental Review Correspondence," chronologically lists all other correspondence.

## 1.10 Status of Compliance

When developing this site-specific EIS, the NRC staff identified no significant new information that would change this discussion in the FSEIS and, therefore, the staff incorporates that discussion herein by reference.

## 1.11 Related State and Federal Activities

When developing this site-specific EIS, the NRC staff identified no significant new information that would change this discussion in the FSEIS and, therefore, the staff incorporates that discussion herein by reference.

# 2 ENVIRONMENTAL CONSEQUENCES AND MITIGATING ACTIONS

## 2.1 Introduction

In this chapter, the U.S. Nuclear Regulatory Commission (NRC, the Commission) staff evaluates the environmental consequences of the Florida Power & Light Company's (FPL, the licensee) continued operation of Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point, Turkey Point Units 3 and 4) for an additional 20 years under the terms of subsequent renewed licenses.

In 2019, the NRC staff prepared the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (NUREG–1437, Supplement 5, Second Renewal) (FSEIS) for the Turkey Point subsequent license renewal (SLR) application (NRC 2019a) in accordance with the NRC's environmental protection regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," which implement the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4321 et seq.).

In the FSEIS, the NRC staff evaluated the environmental issues that are applicable to Turkey Point SLR. For some of these issues (site-specific or Category 2 issues), the NRC staff performed site-specific analyses and reached conclusions specific to the Turkey Point site. For the remaining environmental issues (generic or Category 1 issues), the NRC staff relied upon the analyses and conclusions in NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (LR GEIS) (NRC 2013a), and considered any new and significant information that might change those conclusions. The staff concluded that the impacts of these issues would be SMALL for Turkey Point SLR. However, as explained in Chapter 1 of this environmental impact statement (EIS), the Commission later determined that the LR GEIS did not consider SLR and, therefore, the NRC staff's environmental review for Turkey Point SLR was inadequate in its evaluation of the Category 1 issues (NRC 2022a, 2022b). This EIS addresses the Commission's determination by providing the NRC staff's site-specific analysis of the environmental issues that were previously addressed as generic Category 1 issues. Table 2-1 lists these issues and the NRC staff's findings related to the issues specific to Turkey Point SLR.

Additionally, in this EIS the NRC staff considers whether there is significant new information that would change the staff's conclusions concerning the Category 2 environmental issues for which the staff performed site-specific analyses and made site-specific conclusions in the FSEIS. In 2021, the NRC reinitiated consultation with the U.S. Fish and Wildlife Service (FWS) because FPL exceeded the allowable take of American crocodile (*Crocodylus acutus*). As a result of the reinitiated consultation, the FWS revised the amount of allowable take of the American crocodile. Appendix B, Section B.1 describes this consultation. Although this information is new because it has transpired since the issuance of the FSEIS, the staff determined that it does not affect the conclusions made in the FSEIS concerning federally protected ecological resources. For all other Category 2 issues, the NRC staff has identified no significant new information that would change the conclusions reached in the FSEIS. Therefore, the analyses and conclusions in the FSEIS remain valid for these issues, and that information is incorporated herein by reference. Table 2-2 lists these issues, the relevant sections of the FSEIS in which a discussion of the issues can be found, and the FSEIS's conclusions.

Finally, the NRC staff considered whether any additional environmental issues exist for Turkey Point SLR that were not addressed previously. The NRC staff identified no such issues. Together, this EIS and the FSEIS evaluate, on a site-specific basis, all of the environmental impacts of continued operation during the SLR term for Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and for Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

**Table 2-1 Site-Specific Conclusions Regarding Turkey Point SLR Made in this EIS**

| Resource Area | Environmental Issue | Impacts |
|---|---|---|
| Land Use | Onsite land use | SMALL |
| Land Use | Offsite land use | SMALL |
| Land Use | Offsite land use in transmission line rights-of-way (ROWs) | SMALL |
| Visual Resources | Aesthetic impacts | SMALL |
| Air Quality | Air quality impacts | SMALL |
| Air Quality | Air quality effects of transmission lines | SMALL |
| Noise | Noise impacts | SMALL |
| Geologic Environment | Geology and soils | SMALL |
| Surface Water Resources | Surface water use and quality (non-cooling system impacts) | SMALL |
| Surface Water Resources | Discharge of metals in cooling system effluent | SMALL |
| Surface Water Resources | Discharge of biocides, sanitary wastes, and minor chemical spills | SMALL |
| Surface Water Resources | Effects of dredging on surface water quality | SMALL |
| Groundwater Resources | Groundwater contamination and use (non-cooling system impacts) | SMALL |
| Groundwater Resources | Groundwater quality degradation resulting from water withdrawals | SMALL |
| Groundwater Resources | Groundwater quality degradation (plants with cooling ponds in salt marshes) | SMALL to MODERATE |
| Groundwater Resources | Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) | SMALL to MODERATE |
| Terrestrial Resources | Exposure of terrestrial organisms to radionuclides | SMALL |
| Terrestrial Resources | Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) | SMALL |
| Terrestrial Resources | Bird collisions with plant structures and transmission lines | SMALL |
| Terrestrial Resources | Transmission line right-of-way management impacts on terrestrial resources[(c)] | SMALL |
| Terrestrial Resources | Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) | SMALL |
| Aquatic Resources | Entrainment of phytoplankton and zooplankton | SMALL |
| Aquatic Resources | Infrequently reported thermal impacts | SMALL |
| Aquatic Resources | Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication | SMALL |
| Aquatic Resources | Effects of nonradiological contaminants on aquatic organisms | SMALL |
| Aquatic Resources | Exposure of aquatic organisms to radionuclides | SMALL |

**Table 2-1 Site-Specific Conclusions Regarding Turkey Point SLR Made in this EIS (Continued)**

| Resource Area | Environmental Issue | Impacts |
|---|---|---|
| Aquatic Resources | Effects of dredging on aquatic organisms | SMALL |
| Aquatic Resources | Effects on aquatic resources (non-cooling system impacts) | SMALL |
| Aquatic Resources | Impacts of transmission line right-of-way management on aquatic resources[(c)] | SMALL |
| Aquatic Resources | Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses | SMALL |
| Socioeconomics | Employment and income, recreation and tourism | SMALL |
| Socioeconomics | Tax revenues | SMALL |
| Socioeconomics | Community services and education | SMALL |
| Socioeconomics | Population and housing | SMALL |
| Socioeconomics | Transportation | SMALL |
| Human Health | Radiation exposures to the public | SMALL |
| Human Health | Radiation exposures to plant workers | SMALL |
| Human Health | Human health impact from chemicals | SMALL |
| Human Health | Microbiological hazards to plant workers | SMALL |
| Human Health | Physical occupational hazards | SMALL |
| Postulated Accidents | Design basis accidents | SMALL |
| Postulated Accidents | Severe accidents | Probability-weighted consequences of severe accidents are SMALL |
| Waste Management | Low-level waste storage and disposal | SMALL |
| Waste Management | Onsite storage of spent nuclear fuel | SMALL |
| Waste Management | Offsite radiological impacts of spent nuclear fuel and high-level waste disposal | [(a)] |
| Waste Management | Mixed-waste storage and disposal | SMALL |
| Waste Management | Nonradioactive waste storage and disposal | SMALL |
| Uranium Fuel Cycle | Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste | SMALL |
| Uranium Fuel Cycle | Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste | [(b)] |
| Uranium Fuel Cycle | Nonradiological impacts of the uranium fuel cycle | SMALL |
| Uranium Fuel Cycle | Transportation | SMALL |
| Termination of Nuclear Power Plant Operations and Decommissioning | Termination of plant operations and decommissioning | SMALL |

(a) The ultimate disposal of spent nuclear fuel and high-level waste in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this site-specific review. The environmental impact of this issue for the time frame beyond the licensed life for reactor operations is contained in NUREG–2157, the NRC's "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel." Per 10 CFR Part 51 Subpart A, the Commission determined that the impacts presented in NUREG–2157

**Table 2-1 Site-Specific Conclusions Regarding Turkey Point SLR Made in this EIS (Continued)**

| Resource Area | Environmental Issue | Impacts |
|---|---|---|

would not be sufficiently large to require the conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants and does not warrant a site-specific analysis.

(b) There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission determined that the collective impacts are acceptable. The Commission also determined that the impacts would not be sufficiently large to require the conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered generic to all nuclear power plants and does not warrant a site-specific analysis.

(c) This issue applies only to the in-scope portion of electric power transmission lines, which are defined as transmission lines that connect the nuclear power plant to the substation where electricity is fed into the regional power distribution system and transmission lines that supply power to the nuclear power plant from the grid.

**Table 2-2 Site-Specific Conclusions Regarding Turkey Point SLR Made in the FSEIS**

| Resource Area | Environmental Issue | FSEIS Section | Impacts[a] |
|---|---|---|---|
| Groundwater Resources | Groundwater use conflicts (plants that withdraw more than 100 gallons per minute [gpm]) | 4.5.1 | SMALL to MODERATE |
| Groundwater Resources | Radionuclides released to groundwater | 4.5.1 | SMALL |
| Terrestrial Resources | Effects on terrestrial resources (non-cooling system impacts) | 4.6.1 | SMALL |
| Aquatic Resources | Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) | 4.7.1 | SMALL to MODERATE[b] |
| Aquatic Resources | Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) | | SMALL to MODERATE[b] |
| Special Status Species and Habitats | Threatened, endangered, and protected species and essential fish habitat | 4.8.1 | Impact determinations vary by species and habitat[c] |
| Historic and Cultural Resources | Historic and cultural resources | 4.9.1 | Would not adversely affect known historic properties or historic and cultural resources[d] |
| Human Health | Chronic effects of electromagnetic fields | 4.11.1 | Uncertain Impact |
| Human Health | Electric shock hazards[e] | 4.11.1 | SMALL |

**Table 2-2 Site-Specific Conclusions Regarding Turkey Point SLR Made in the FSEIS (Continued)**

| Resource Area | Environmental Issue | FSEIS Section | Impacts[(a)] |
|---|---|---|---|
| Environmental Justice | Minority and low-income populations | 4.12.1 | No disproportionately high and adverse human health and environmental effects |
| Cumulative Impacts | Cumulative impacts | 4.16 | See FSEIS Section 4.16 |

(a) In reciting the FSEIS conclusions here, the NRC staff notes that the impact determinations for these issues were described in Chapter 4 of the FSEIS. These impact findings are incorporated herein by reference.
(b) The NRC staff notes that the FSEIS conclusion of "SMALL to MODERATE" applies to aquatic resources in the cooling canal system. Aquatic organisms inhabiting Biscayne Bay and connected water bodies (e.g., Card Sound, the Atlantic Ocean) are not subject to impingement and entrainment because they do not interact with the Turkey Point intake structure, and there are no thermal effects outside the cooling canal system because there are no surface water connections that allow flow between the waters of Biscayne Bay and the cooling canal system.
(c) In the FSEIS, the NRC staff concluded that Turkey Point SLR is likely to adversely affect the American crocodile and the eastern indigo snake and may result in adverse modification of the designated critical habitat of the American crocodile. The FSEIS also concluded that the proposed action may affect but is not likely to adversely affect the Florida panther, West Indian manatee, red knot, wood stork, loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, and smalltooth sawfish. The FSEIS further concluded that the proposed action would result in no adverse modification of designated critical habitat of the West Indian manatee. The NRC staff's evaluation of impacts on federally listed species and critical habitats under the U.S. Fish and Wildlife Service's (FWS) jurisdiction appears in the NRC's Biological Assessment (NRC 2018). The FWS's separate evaluation and conclusions appear in a July 25, 2019, biological opinion (FWS 2019), which is described in Section 4.8.1.1 of the FSEIS. The FWS later amended its biological opinion on March 21, 2022 (FWS 2022). The NRC staff's evaluation of impacts on federally listed species and critical habitats under the National Marine Fisheries Service's jurisdiction appears in Section 4.8.1.1 of the FSEIS. The FSEIS concluded that the proposed action would have no adverse effects on essential fish habitat. The NRC staff's evaluation of impacts on essential fish habitat appears in Section 4.8.1.2 of the FSEIS. The NRC staff also concluded in the FSEIS that the proposed action would not affect the sanctuary resources of the Florida Keys National Marine Sanctuary. The NRC staff's evaluation of sanctuary resources appears in Section 4.8.1.3 of the FSEIS.
(d) The NRC staff notes that based on (1) the location of National Register of Historic Places-eligible historic properties within the area of potential effect, (2) Tribal input, (3) FPL's cultural resource protection plans, (4) the fact that no license renewal-related physical changes or ground-disturbing activities would occur, (5) Florida State Historic Preservation Office input, and (6) cultural resource assessment, the FSEIS concluded that Turkey Point SLR would not adversely affect any known historic properties. See FSEIS Table 2-2.
(e) The NRC staff notes that this issue applies only to the in-scope portion of electric power transmission lines, which are defined as transmission lines that connect the nuclear power plant to the substation where electricity is fed into the regional power distribution system and transmission lines that supply power to the nuclear power plant from the grid.

## 2.2 Land Use

License renewal has had little or no effect on land use on or near the nuclear power plant site. Industrial land use activities at Turkey Point are not expected to change appreciably until sometime after decommissioning. Similarly, land use activity within transmission line rights-of-way (ROWs) would continue with no change in land use restrictions, and easements are expected to remain unchanged during the SLR term. The following sections address the site-specific environmental impacts of Turkey Point SLR on three environmental issues related to land use.

### 2.2.1 Onsite Land Use

Operational activities during the SLR term would be similar to those already occurring at Turkey Point. The industrial nature of onsite land use would continue unchanged. However, additional space within the site could be needed for new or expanded onsite storage of the spent nuclear fuel and low-level radioactive waste generated during the SLR term. The exact size and location of any such additional storage cannot be known at this time. However, the applicant indicates that the amount of additional space needed for these activities would be relatively small—2.5 to 10 acres (ac) (1 to 4 ha) (FPL 2018a). This would be addressed in separate licensing actions and environmental reviews of any future application to expand onsite spent fuel and/or low-level waste storage capacity, as appropriate.

Based on these considerations, the NRC staff concludes that the impact of continued nuclear power plant operations on onsite land use during the Turkey Point SLR term would be SMALL. In addition, the NRC staff did not identify any new information that would alter this conclusion.

### 2.2.2 Offsite Land Use

License renewal activities have had little to no effect on population or tax revenue in communities near nuclear power plants. Employment levels at Turkey Point have remained the same or have slightly decreased with no increased demand for housing, infrastructure improvements, or services. Operational activities during the SLR term would be similar to those already occurring at Turkey Point and would not affect offsite land use beyond what has already been affected.

Section 307(c)(3)(A) of the Coastal Zone Management Act of 1972, as amended (CZMA; 16 U.S.C. 1456), requires that applicants for Federal licenses who conduct activities in a coastal zone provide a certification that the proposed activity complies with the enforceable policies of the State's coastal zone program. Turkey Point Units 3 and 4 are within the Florida coastal zone. The Florida Department of Environmental Protection (FDEP) issued a license that constitutes concurrence that FPL's activities at Turkey Point are consistent with those addressed in the State of Florida's approved coastal zone management program. The most recent certification for Turkey Point Units 3 through 5 (FDEP 2012) shows Turkey Point Units 3 and 4 as being consistent with Florida's coastal zone program in 2008, with several modifications since then, the most recent having been issued on January 24, 2022 (FDEP 2022a).

Land to the south and west of the Turkey Point site is in the Everglades Mitigation Bank where wetlands are created, restored, or enhanced to provide compensatory mitigation of wetland losses elsewhere. Under the joint federally and State-operated mitigation bank program, both public and private entities can own lands managed under the program. FPL owns the Everglades Mitigation Bank land, which comprises approximately 13,000 ac (5,300 ha) of relatively undisturbed freshwater and estuarine wetlands. The U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (EPA), the Natural Resources Conservation Service, the FWS, and the National Marine Fisheries Service (NMFS) review and comment on mitigation bank permit applications and subsequent Mitigation Banking Instruments issued by the USACE to ensure consistency with specific laws and provisions, including the Section 404 of the Federal Water Pollution Control Act of 1972, as amended (33 U.S.C. 1251 et seq.) (also known as the Clean Water Act [CWA]) (FWPCA 1972), permit program, the wetland conservation provisions of the Food Security Act of 1985, NEPA, and several other statutory provisions. The FDEP permits mitigation banks for utility companies within Florida pursuant to

the Florida Mitigation Banking Rule and other State authorities. FPL must comply with those requirements, assuring that SLR operations at Turkey Point will be consistent with mitigation bank requirements.

Based on these considerations, the NRC staff concludes that the impact of continued nuclear power plant operations offsite land use during the Turkey Point SLR term would be SMALL. In addition, the NRC staff did not identify any new information that would alter this conclusion.

### 2.2.3 Offsite Land Use in Transmission Line Rights-of-Way

Maintenance activities in transmission line ROWs during the license renewal term, would be the same as or similar to those already occurring and would not affect offsite land use beyond what has already been affected. Transmission line ROWs do not preclude the use of the land for other purposes, such as agriculture and recreation. However, land use is limited to activities that do not endanger power line operation.

Based on these considerations, the NRC staff concludes that the impact of continued nuclear power plant operations during the Turkey Point SLR term on offsite land use in transmission line ROWs would be SMALL. In addition, the NRC staff did not identify any new information that would alter this conclusion.

## 2.3 Visual Resources

The visual appearance of Turkey Point and associated transmission lines have become well established during the current licensing term and are not likely to change appreciably over time. The following section addresses the site-specific environmental impacts of Turkey Point SLR on one environmental issue related to visual resources.

### 2.3.1 Aesthetic Impacts

The visual impact of continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL, because the visual appearance of the nuclear power plant and transmission lines would not change. In addition, the NRC staff did not identify any new information that would alter this conclusion.

## 2.4 Air Quality

Ambient air quality conditions at Turkey Point and associated transmission lines have been well established during the current licensing term. These conditions are expected to remain unchanged during the SLR term. The following sections address the site-specific environmental impacts of Turkey Point SLR on two environmental issues related to air quality.

### 2.4.1 Air Quality Impacts

The Clean Air Act of 1970, as amended (42 U.S.C. 7401 et seq.), Title V, “Permits,” requires States to develop and implement an air pollution permit program (CAA 1970). The FDEP regulates air emissions at Turkey Point under Title V air operation permits (FDEP 2020a, 2020b, 2023; FPL 2023a).

Combined Turkey Point Units 3, 4, and 5 are considered one facility for purposes of the Prevention of Significant Deterioration permitting program and Title V operating permits.

However, FPL operates these units under two separate Title V permits: one for fossil fuel Unit 5 (Permit 0250003-032-AV) (Unit 1, which has been retired, was deleted from the permit upon its renewal in November 2018), and another for nuclear Units 3 and 4 (Permit 0250003-036-AV) (FDEP 2020a, FDEP 2023).

The FDEP issued the previous permit, Title V Air Operation Permit 0250003-033-AV, for Turkey Point Units 3 and 4 in May 2020; it was set to expire in 2023 (FDEP 2020b). In September 2022, FPL submitted an application to renew this air operation permit for 5 years. In March 2023, FDEP issued Air Operation Permit 0250003-036-AV for Units 3 and 4 (FDEP 2023). A similar process is being used for fossil fuel Unit 5 (FDEP 2023; FPL 2023a).

The ambient air quality in the vicinity of Turkey Point is described in Section 3.3.2 of the FSEIS (NRC 2019a). Table 2-3 presents updated annual emissions from permitted sources at Turkey Point Units 3 and 4. Turkey Point employs five emergency diesel generators for use as a backup power source to the nuclear power plant. These generators provide a standby source of electric power for essential equipment required during an emergency. They also allow for safe reactor shutdown and for the maintenance of safe conditions. Each generator is tested on a staggered test schedule (e.g., once every refueling outage). Turkey Point also employs emergency diesel generators supporting meteorological tower and fire pump operation. FPL operates these diesel generators/engines at Turkey Point Units 3 and 4 only intermittently (usually during testing or during outages).

**Table 2-3 Estimated Air Pollutant Emissions (tons/year) from Turkey Point Units 3 and 4**

| Year | $SO_x$ | $NO_x$ | CO | $PM_{10}$ | VOCs |
|---|---|---|---|---|---|
| 2017 | 1.39 | 14.2 | 1.82 | 1.64 | 0.71 |
| 2018 | 0.03 | 10.6 | 2.83 | 0.18 | 0.31 |
| 2019 | 0.03 | 11.1 | 2.97 | 0.18 | 0.33 |
| 2020 | 0.01 | 13.1 | 3.92 | 0.22 | 0.36 |
| 2021 | 0.04 | 10.0 | 2.70 | 0.17 | 0.32 |

$CO$ = carbon monoxide; $NO_x$ = nitrogen oxides; $SO_x$ = sulfur dioxides; $PM_{10}$ = particulate matter less than 10 micrometers; VOC = volatile organic compounds.

To convert tons per year to metric tons per year, multiply by 0.90718.

Note: In 2018, FPL standardized the emissions calculations for its fleet. For Turkey Point, the calculations were changed from being performance factor-based to being derived from standard emission factors defined by the U.S. Environmental Protection Agency in *Compilation of Air Pollutant Emission Factors* (AP-42).

Source: FPL 2023a.

According to the 2017 National Emissions Inventory, estimated annual emissions in tons per year for Miami-Dade County are approximately 1,210 (sulfur dioxide), 33,800 (nitrogen dioxide), 256,000 (carbon monoxide), 28,200 (particulate matter less than 10 microns), and 83,400 (volatile organic compounds) (EPA 2023). Turkey Point Units 3 and 4 air emissions from permitted sources make up 0.1 percent or less of Miami-Dade County's total annual emissions.

SLR for Turkey Point Units 3 and 4 would continue current operating conditions and environmental stressors rather than introducing wholly new impacts. Therefore, the impacts of current operations and operations under SLR would be similar. Given Turkey Point Units 3 and 4's limited air emissions as presented in Table 2-3, there is little likelihood that a continuation of ongoing activities at Turkey Point Units 3 and 4 during the SLR term would adversely affect air quality and air quality-related values. Based on these considerations, the NRC staff concludes

that the air quality impacts of continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL. In addition, the NRC staff did not identify any new information that would alter this conclusion.

### 2.4.2 Air Quality Effects of Transmission Lines

Small amounts of ozone and substantially smaller amounts of oxides of nitrogen are produced during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface of transmission lines. FPL has not conducted field tests of ozone and nitrogen oxide emissions generated by Turkey Point transmission lines (FPL 2023a). However, because transmission line emissions associated with corona discharge are typically so small compared to those from other sources of air pollution (e.g., ozone precursors from automobiles, power plants, and large industrial boilers), corona-related transmission line emissions are not a regulated source of air pollution in the United States.

SLR would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and operations during SLR would be similar. For these reasons, the effects of transmission lines on air quality would be minor and would neither destabilize nor noticeably alter any important air quality attribute during the SLR term. Based on these considerations, the NRC staff concludes that the impacts of transmission lines on air quality during the Turkey Point SLR term would be SMALL. In addition, the NRC staff did not identify any new information that would alter this conclusion.

## 2.5 Noise

Noise from nuclear power plant operations can often be detected offsite near the site boundary. Major sources of noise include cooling towers, turbines, transformers, large pumps, firing range, steam safety relief valves, and cooling water system motors. Ambient noise conditions near Turkey Point have become well established during the current licensing term. These conditions are expected to remain unchanged during the SLR term. The following section addresses the site-specific environmental impacts of Turkey Point SLR on one environmental issue related to noise.

### 2.5.1 Noise Impacts

The ambient noise conditions in the vicinity of Turkey Point are described in Section 3.3.3 of the FSEIS (NRC 2019a). Nuclear power plant operations have not changed appreciably over time, and no change in noise levels or noise-related impacts are expected during the SLR term. Given the industrial nature of the nuclear power plant and the number of years of plant operation, noise from a nuclear power plant is generally nothing more than a continuous minor nuisance.

In the 1996 LR GEIS, the NRC noted that there have been few complaints about noise at nuclear power plants, and that noise impacts have been found to be small (NRC 1996). Because noise sources at nuclear power plants do not change appreciably during the aging process, the 1996 LR GEIS concluded that noise was not expected to be a problem at any nuclear power plant during the license renewal term and, given the few noise complaints received, that no additional mitigation measures are warranted. The magnitude of noise impacts was therefore determined to be SMALL for all nuclear power plants.

In 2008, an ambient noise-monitoring survey was performed in areas adjacent to the Turkey Point site (NRC 2014a). Measurements (equivalent sound intensity level) at monitoring locations offsite and beyond the site boundary (including nearest residence, day-care facility, and a park) ranged from 46 dBA to 67 dBA during the daytime and from 41 dBA to 56 dBA during the nighttime. Audible noise sources contributing to noise levels included traffic, insects, and wind, indicating that audible sound from the Turkey Point site does not reach these noise-sensitive receptors.

Plant operations at Turkey Point during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR operations would be similar. Based on these considerations, the NRC staff concludes that the noise impacts of continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL. In addition, the NRC staff did not identify any new information that would alter this conclusion.

## 2.6 Geologic Environment

The following section addresses the site-specific environmental impacts of Turkey Point SLR on one environmental issue related to the geologic environment.

### 2.6.1 Geology and Soils

The 2013 LR GEIS (NRC 2013a) indicated that the impact of continued plant operations and any refurbishment associated with license renewal on geologic and soil resources would involve soil and subsurface disturbance, such as sediment and/or any associated bedrock, related to replacing or adding buildings, roads, parking lots, and below-grade and above-grade utility structures, and subsequent soil erosion and impacts on surface water quality. The impacts of natural phenomena, such as geologic hazards, on nuclear power plant systems, structures, and components are outside the scope of the NRC's license renewal environmental review; they are addressed in the reactor oversight process and in the staff's plant-specific severe accident evaluation and safety review during license renewal.

FPL has not planned any refurbishment activities or construction of new facilities related to SLR at Turkey Point (FPL 2018f). Land disturbance activities for continued nuclear power plant operations at Turkey Point during the SLR term would be associated with routine infrastructure maintenance, upgrade, renovation, or replacement as needed to support Turkey Point operation.

FPL has internal procedures and plans (e.g., Administrative Procedure No. 0-ENV-0601, stormwater pollution prevention plans [SWPPP], best management practices [BMPs], etc.) in place to ensure compliance with existing comprehensive environmental regulations and permits. These procedures and plans would minimize or prevent potential impacts (e.g., stormwater induced erosion and sediment transport) from ground-disturbing activities during the SLR term (FPL 2018b; FDEP 2022b).

In addition, conditions in the industrial wastewater (IWW)/National Pollutant Discharge Elimination System (NPDES) permit for Turkey Point contain specific requirements for implementing a BMP plan covering both industrial wastewater and stormwater. FPL is required to inspect components of the Turkey Point cooling canal system (CCS) for changes that may indicate a potential compromise of the impoundment integrity (FDEP 2022b). Soil disturbance for CCS maintenance and sediment removal is conducted in accordance with FPL internal

procedures, the sediment removal maintenance support package, and a terrestrial vegetation plan. These guidance documents minimize or prevent impacts on soils and near subsurface geology in and around the CCS.

Based on these considerations, the NRC staff concludes that the impacts on soils and the geologic environment due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.7 Surface Water Resources

The following sections address the site-specific environmental impacts of Turkey Point SLR on four environmental issues related to surface water resources.

### 2.7.1 **Surface Water Use and Quality** (Non-Cooling System Impacts)

This section concerns surface water use and its potential degradation in quality due to continued nuclear power plant operations at Turkey Point during the SLR term that are unrelated to the operation of the Turkey Point cooling system. Activities associated with such plant operations and refurbishment can result in a variety of pollutants (e.g., suspended sediments, petroleum products including oil and other chemicals, paints, heavy metals, and road salts) entering surface water bodies by way of, for instance, stormwater runoffs. These pollutants could potentially degrade water quality, impair its designated uses, and cause harm to aquatic terrestrial species (NRC 2013a). Water uses related to such plant operation and refurbishment activities can include concrete production, dust control, washing stations, and facility and equipment cleaning.

FPL does not use or have plans to access surface water for non-cooling purposes at Turkey Point. The water source at Turkey Point for its systems other than the cooling water system is a municipal supply (i.e., domestic water) (FPL 2018f, Section 2.2.3.1) and treated groundwater, which is used for process water.

FPL does not anticipate any refurbishment activities or construction of new facilities at Turkey Point during the SLR term. Land-disturbing activities for continued nuclear power plant operations at Turkey Point during the SLR term would be limited to the routine maintenance, upgrade, or replacement of infrastructure as needed. FPL has internal procedures and plans for such construction activities, including stormwater permitting requirements and State-required BMPs (e.g., SWPPPs), to minimize or prevent soil erosion and sediment transport (FPL 2018g, RAI T-6).

Turkey Point effluents, except for treated wastewater, are routed to the closed-loop CCS. The CCS is a permitted IWW facility (Permit No. FL0001562) and does not discharge through a point source to surface waters of the state, although some CCS waters have infiltrated to the underlying Biscayne Aquifer at the facility (FDEP 2016b). As required by permit conditions, FPL institutes stormwater and IWW programs to prevent or minimize the generation and potential for releases of pollutants from nuclear power plant operations via stormwater and the CCS.

Stormwater runoff collects in drainage channels and typically flows through a series of stormwater catch basins before discharging to the CCS, while equipment and containment area drains are routed to oil/water separators prior to being routed to the CCS (FPL 2018f, Sections 2.2.3 and 3.6.1.4.2; 2022a). FPL assesses facility components and systems under the IWW BMPs program for possible waste minimization and implements measures to reduce

waste loadings and chemical losses to wastewater and stormwater streams. FPL further incorporates its findings of potential vulnerabilities in the components and systems into the BMPs to effectively conduct inspection and maintenance of stormwater management devices. FPL also implements a spill prevention, control, and countermeasure (SPCC) plan that addresses storage, secondary containment, and inspections. No reportable spills occurred at Turkey Point from 2012 to March 2022 (FPL 2022a).

FPL has not planned any refurbishment activities or construction of new facilities related to SLR at Turkey Point. Land disturbance activities for continued nuclear power plant operations at Turkey Point during the SLR term would be limited to the routine maintenance, upgrade, or replacement of infrastructure as needed to support Turkey Point operation. FPL would follow its internal procedures and plans related to construction activities, including stormwater permitting requirements and the State-required BMPs (i.e., SWPPPs) to minimize or prevent soil erosion and sediment transport (FPL 2018g, RAI T-6).

In 2010, FPL implemented surface water quality and environmental monitoring in the CCS and area surrounding the nuclear power plant based on the monitoring network designed with State and local input (i.e., FDEP, Miami-Dade County Department of Environmental Resources Management, and the South Florida Water Management District). There have been no reported violations related to surface water quality as a result of Turkey Point nuclear power plant operation (FPL 2022a). In the 2019 FSEIS, the NRC staff identified a new issue: a nuclear power plant with a cooling pond in a salt marsh may indirectly affect the water quality of adjacent surface water bodies via a groundwater pathway (NRC 2019a). Because the CCS is unlined, the water in it can and has interacted with the underlying shallow groundwater system. The operation of the CCS has contributed to the degradation of groundwater quality beyond the Turkey Point site boundaries, as discussed in the groundwater resources section of this EIS (Section 2.8). However, based on a site-specific analysis of this issue, the NRC staff did not identify any new information that would change the staff's FSEIS conclusion that the impacts on adjacent surface water bodies via the groundwater pathway from the CCS during the Turkey Point SLR term would be SMALL.

Based on its review of available information, the NRC staff understands that FPL does not use or plan to use surface water for nuclear power plant operations at Turkey Point and would obtain all necessary permits if such a need for surface water occurs during the SLR term. FPL would continue to comply with the current IWW/NPDES and stormwater regulatory requirements and permit conditions and implement the SWPPP, BMPs, and SPCC plan to minimize or prevent impacts on surface water quality during the SLR term. FPL would also continue surface water quality and environmental monitoring programs at the site. The NRC staff concludes that the impacts on surface water use and quality would be SMALL for continued nuclear power plant operations at Turkey Point during the SLR term.

### 2.7.2 Discharge of Metals in Cooling System Effluent

This section addresses potential leaching of heavy metals, such as copper, zinc, and chromium, from condenser tubing and other components of the nuclear power plant heat exchange system by circulating cooling water (NRC 2013a). Parts of the water distribution system infrastructure and appurtenances, piping, linings, fixtures, and solders can react with water and potentially release heavy metals to the distributed water. Permeation of plastic pipes and leaching from linings and metal appurtenance are documented pathways for water quality degradation (EPA 2002). These dissolved metals are normally the subject of an NPDES permit because elevated metal concentrations can become toxic to aquatic organisms. During normal nuclear power

plant operations, heavy metal concentrations are generally below laboratory detection levels. However, elevated metal concentrations may occur after plants occasionally undergo planned outages for refueling or unplanned maintenance, with stagnant water remaining in the heat exchange system.

At Turkey Point, circulating cooling water is supplied from and discharged to a closed-loop CCS that is a permitted IWW facility (Permit No. FL0001562). The CCS waters, with permitted chemical additives used in the nuclear power plant system, are not allowed to discharge to non-CCS surface waters through a point source, although some CCS waters have infiltrated to the underlying Biscayne Aquifer at the site (FPL 2000, FDEP 2016b). Corrosion inhibitors, which are used to minimize system degradation, and release of metals to the CCS are among the chemicals authorized by the Turkey Point IWW/NPDES permit (FPL 2022a). FPL is prohibited from discharging waste resulting from the combustion of toxic, hazardous, or metal-cleaning wastes to any waste stream that ultimately reaches the CCS.

Water pH can strongly affect metal mobility. The mean measured pH of the CCS was 8.24 from June 2010 to December 2017, with a range from 7.78 to 8.72 based on the 10th and 90th percentiles, respectively (FPL 2018h). The mean pH of the CCS has essentially remained constant at 8.22 from June 2020 to March 2021 (FPL 2022a). These above-neutral pHs will limit metal dissolution in the CCS waters at the site (Hoffland 2019) and in the circulating cooling water system.

Based on its site-specific review, the NRC staff has determined that Turkey Point discharges only to the closed CCS, a permitted IWW facility. The permit to operate that facility requires CCS monitoring for copper, zinc, and other constituents. In addition, the use of corrosion inhibitors as permitted, the maintenance of an above-neutral pH, and other BMPs to control pollutants to the maximum extent practicable during continued operations of the nuclear power plant will limit the dissolution and release of metals from the plant's water distribution system infrastructure and appurtenances and from other activities or events at the plant. The NRC staff concludes that the impacts from the discharges of heavy metals in cooling system effluent due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.7.3 Discharge of Biocides, Sanitary Wastes, and Minor Chemical Spills

This issue addresses concerns about biocides, sanitary wastes, and minor chemical spills discharging to surface water bodies (NRC 2013a). The application of biocides and other water treatment chemicals is common and necessary to control biofouling and nuisance organisms in nuclear power plant cooling systems. The types of chemicals, concentrations, and frequency of their use, however, are specific to each plant. Treated sanitary waste may be released via onsite wastewater treatment facilities, a septic field, or through a connection to a municipal sewage system. Minor chemical spills may be collected in floor drains. Each of these activities or events has the potential to affect surface water quality.

FPL stated in ER Supplement 2 (FPL 2022a) that the Turkey Point cooling water and non-cooling water discharges are directed to the closed CCS under an IWW/NPDES permit (Permit No. FL0001562), and treated domestic wastewater is permitted to be injected into an underground geologic formation. The CCS is not directly connected to any surface water bodies (FPL 2018f). The IWW/NPDES permit authorizes FPL to use specific biocides or, with FDEP prior approval, other non-permitted biocides or chemical additives in the CCS or any other portion of the IWW system (FDEP 2022b. The discharge of any waste resulting from the

combustion of toxic, hazardous, or metal-cleaning wastes directly or indirectly to the CCS is prohibited under the IWW/NPDES permit. FPL discharges its sanitary wastewater to a septic system under Florida Department of Health (FDOH) Permit No. AP998256 (FDOH 2022) and to a subsurface injection well (Permit No. 0355186-001-UO/5W) after treatment (FDEP 2018b; FPL 2018f [Section 2.2.3.1 in both permits]).

Effluents for all other systems, including stormwater runoff and equipment and containment area drains, are routed to the closed-loop, unlined CCS under the conditions specified in the IWW/NPDES permit. Stormwater runoff flows through a series of catch basins, while equipment and containment area drain effluents are routed to oil/water separators prior to being discharged to the CCS (FDEP 2022b, FPL 2018f [Sections 2.2.3 and 3.6.1.4.2, respectively]). Under 40 CFR Part 112, "Oil Pollution Prevention," FPL implements an SPCC plan, including measures such as containments, automatic spill and overfill detection systems, and an inspection program, along with BMPs for storage and handling to prevent and control accidental spills. There were no reported spills at Turkey Point during the period from 2012 to March 2022 (FPL 2022a).

In summary, Turkey Point discharges to the closed-loop CCS with no direct connection to any surface water bodies under an IWW/NPDES permit. Certain specific biocides and chemicals allowed to be used with approval by the FDEP are monitored and reported to ensure compliance with the permit. Turkey Point discharges sanitary wastewater to a septic system and to a permitted deep injection well after treatment.

Based on its site-specific review, the NRC staff concludes that the impacts from the discharge of biocides, sanitary wastes, and minor chemical spills due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL

### 2.7.4 Effects of Dredging on Surface Water Quality

This issue concerns the effects on surface water quality of dredging deposited sediments in the vicinity of surface intakes, canals, and discharge structures primarily to maintain the function of the nuclear power plant cooling system. Dredging by mechanical, suction, or other methods disturbs sediments, temporarily increases the turbidity of the water column, and may mobilize heavy metals and other contaminants in the sediments, if present.

The 2013 LR GEIS (NRC 2013a) concluded that the effects of dredging on surface water quality would be SMALL during the initial license renewal term. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

FPL anticipates no dredging within the scope of this issue during the Turkey Point SLR term (FPL 2022a). Therefore, there would be no related impacts on surface water quality. Because the closed-loop CCS is not considered to be a water of the United States, but an IWW facility, maintenance dredging activities within the CCS are outside the scope of this issue. However, if FPL were to determine at a future date that dredging was necessary to, for instance, provide adequate clearance for barge deliveries, such dredging would require FPL to obtain permits from the USACE under CWA Section 404. BMPs and conditions associated with those permits would minimize impacts on the environment. The process of granting such permits would also require the USACE to conduct environmental reviews prior to FPL undertaking such dredging.

The NRC staff expects that the effects of dredging on surface water quality would be minor and would neither destabilize nor noticeably alter any important attribute of surface water quality

during the SLR term. The NRC staff expects that FPL would continue to implement site environmental procedures and would obtain any necessary permits for dredging activities, if determined necessary. Implementation of such controls would further reduce or mitigate potential effects on the environment. The NRC staff concludes that the effects of dredging on surface water quality due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.8 Groundwater Resources

The following sections address the site-specific environmental impacts of Turkey Point SLR on environmental issues related to groundwater resources.

### 2.8.1 Groundwater Contamination and Use (Non-Cooling System Impacts)

This section concerns the potential impacts on groundwater availability resulting from aquifer dewatering during nuclear power plant operations and refurbishment. In addition, this section concerns impacts on groundwater quality that may occur due to the contamination of soil and groundwater during general industrial activities at the nuclear power plant, including the storage and use of solvents, hydrocarbon fuels (diesel and gasoline), heavy metals, or other chemicals, and operation of wastewater treatment/disposal ponds or lagoons. Materials that are released from these activities all have the potential to affect soils, sediments, and groundwater. Such contaminants that migrate into the subsurface environment can cause a long-term impact on underlying groundwater resources depending on the type of contaminant, the quantity of the release, and site hydrogeological conditions. Potential impacts due to groundwater withdrawals to remediate the hypersaline groundwater plume in the Biscayne Aquifer are presented in Section 2.8.2.

As stated above, FPL has not planned any refurbishment activities or construction of new facilities related to SLR at Turkey Point (FPL 2018a) and, therefore, no dewatering activities would be needed with respect to refurbishment or construction during the SLR term. Additionally, apart from groundwater withdrawals to remediate the hypersaline groundwater plume in the Biscayne Aquifer, discussed in 2.8.2, there are no dewatering activities associated with nuclear power plant operations and none are anticipated during the SLR term. In accordance with the Conditions of Certification and Florida Administrative Code Rule 62-621.300(2), FPL is required to submit a detailed plan for any future dewatering activities at Turkey Point for review and approval by other authorities.

FPL operates five groundwater withdrawal systems at Turkey Point to support plant operation, including (1) CCS freshening wells that withdraw brackish water from the Upper Floridan Aquifer (UFA), (2) Biscayne Aquifer marine wells that withdraw salt water to supplement CCS freshening, (3) several Unit 5 production wells that withdraw brackish water from the UFA to support operations of Turkey Point Unit 5, (4) Recovery Well System (RWS) wells that withdraw saltwater from the Biscayne Aquifer for control of the CCS hypersaline groundwater plume, and (5) Underground Injection Control (UIC) test extraction wells that are also used for hypersaline plume withdrawals. FPL operates all groundwater withdrawal systems in accordance with required permits issued by the State and the water management district. The impacts of withdrawals on water use and groundwater quality were evaluated by FPL to comport with State and district water use rules and criteria prior to water permit issuance (FPL 2018f; SFWMD 2017).

Groundwater use conflicts arising from Biscayne Aquifer and UFA withdrawals were evaluated in Section 4.5.1.2 of the FSEIS under the Category 2 issue, "Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)." New information regarding groundwater use conflicts is evaluated in Section 2.8.2 of this EIS.

The potential effects of groundwater withdrawals on groundwater quality were evaluated generically in the FSEIS under the Category 1 issue, "Groundwater quality degradation resulting from water withdrawals"; those impacts are evaluated on a site-specific basis in Section 2.8.2 of this EIS.

FPL operates one onsite Class V, Group 3 gravity injection well, and one Class I injection well system located approximately 1.1 miles southwest of the nuclear power plant. The onsite gravity injection well is used to dispose of up to 35,000 gpd of treated domestic sanitary wastewater into the Biscayne Aquifer. The Class I injection well system is used to dispose of hypersaline groundwater extracted by the RWS into a deep, confined formation in the aquifer (referred to as the Boulder Zone). As required, FPL monitors discharge volume and permit-specified water quality parameters in both injection systems and is in compliance with permit conditions (FDEP 2018a, FDEP 2018b; 2019, 2019a).

Turkey Point industrial activities involving the use of chemicals include painting, cleaning parts and equipment, storage and refueling onsite vehicles/generators (with fuel oil and gasoline), and storage and use of water treatment additives. Site-specific programs are in place to address accidental spills or releases of chemicals to the environment, including FPL's chemical control procedure and SPCC plan, which addresses storage, secondary containment, and inspections. As described in the Turkey Point SPCC plan, all aboveground storage tanks at the site are equipped with secondary containment and, as appropriate, automatic spill and overfill detection systems. In addition, FPL implements BMPs for storage and handling of containers containing less than 55 gallons of petroleum products. FPL also implements waste management programs to oversee its storage and handling of waste streams (FPL 2018f Section 4.11). There were no reportable spills or releases at the plant during the period from 2012 to December 2022 (FPL 2018e, FPL 2018g, FPL 2023a).

Based on its site-specific analyses, the NRC staff concludes that there are no groundwater dewatering activities in use for the operation of the nuclear power plant and none are anticipated during the SLR term, beyond those associated with groundwater withdrawals to remediate the hypersaline groundwater plume in the Biscayne Aquifer, discussed in Section 2.8.2 of this EIS. The current environmental programs, including water withdrawal and injection permits, IWW/NPDES permits, and stormwater management, are in compliance with regulatory requirements and programs at Turkey Point and are expected to continue to be in compliance during the SLR term. The NRC staff concludes that the environmental impacts on groundwater use and quality from non-cooling systems due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.8.2 Groundwater Use Conflicts and Groundwater Quality Degradation Resulting from Water Withdrawals

This section addresses the potential for groundwater use conflicts and any related groundwater quality degradation as a result of inducing water of potentially lower quality to flow into an aquifer during groundwater withdrawals. In a coastal setting (e.g., ocean shore or estuary), saltwater intrusion into an aquifer is an additional consideration. The magnitude of groundwater use conflicts and the degree of water quality degradation or saltwater intrusion depends on well

locations, screen depths, pumping rates, and other site-specific hydrogeologic conditions (NRC 2013a). Additionally, this section addresses new information regarding groundwater use.

The aquifers underlying the Turkey Point site are the Biscayne Aquifer and the Upper and Lower Floridan Aquifers. The Biscayne and Lower Floridan Aquifers in the area of the Turkey Point site are classified as G-III nonpotable water use and contain hypersaline water and saltwater, respectively. Saltwater intrusion in the Biscayne Aquifer underneath and west of the Turkey Point site has been documented over 4 mi (6.4 km) inland prior to the construction of the CCS (FPL 2022a). The UFA contains brackish water and is classified as G-II potable water use. Turkey Point nuclear power plant operations use five sets of groundwater withdrawal wells as summarized in Table 2-4.

**Table 2-4 Turkey Point Groundwater Withdrawal Wells**

| Well Type | Permit # | Number of Wells | Identifiers | Aquifer | Purpose | Withdrawal Limit |
|---|---|---|---|---|---|---|
| Freshening wells | PA03-45 | 7 | F1 through F7 | Upper Floridan (brackish) | F1/Flex Well: Primary: Provide makeup water to the Condensate Storage Tank F1 alternate and F2-F7 primary: CCS freshening | 10,950 MGY with a maximum monthly withdrawal of 1,033.6 MG (permit limit) |
| Recovery well system | 13-06251-W | 10 | RW-1 through RW-10 | Biscayne (hyper-saline) | Hypersaline groundwater removal | 5,475 MG Annually, 15 MGD 465 MG monthly (permit limit) |
| Unit 5 production wells | PA03-45 | 3 | PW-1, PW-3, and PW-4 | Upper Floridan (brackish) | Turkey Point process water and Unit 5 cooling with blowdown to the CCS | 14.06 MGD (permit limit) |
| UIC test extraction wells | No consumptive use permit required | 4 (2 active, 2 capped and on standby) | UICPW-1, UICPW-2, UICPW-3, and UICPW-4 | Biscayne (hyper-saline) | Extraction for groundwater remediation | 3.5 MGD (based on the UIC rated capacity of 18.64 MGD) |

CCS = cooling canal system; MG = million gallons; MGD = million gallons per day; MGY = million gallons per year; PW = permitted well; RW = recovery well; UIC = Underground Injection Control.
Source: FPL 2022a

### *2.8.2.1 Biscayne Aquifer*

The marine wells, the RWS, and UIC test extractions wells all withdraw water from the Biscayne Aquifer. The marine wells, located on the Turkey Point peninsula, withdraw water that has

chloride concentrations greater than 19,000 mg/L (i.e., saline or saltwater and, therefore, do not require a consumptive use permit from the South Florida Water Management District (SFWMD; FPL 2022a). FPL stated that the marine wells are used only under "extraordinary circumstances" or "upset recovery" conditions to manage salinity in the CCS. No withdrawals were made from the marine wells during the years 2019 to 2021 (FPL 2022a). As discussed in the FSEIS, the periodic use of the marine wells is not expected to have a substantial impact on groundwater quality.

The RWS is required as part of both the 2015 Miami-Dade County Consent Agreement (MDC 2015) and the 2016 FDEP Consent Order (FDEP 2016b). It includes 10 groundwater recovery wells to remediate the hypersaline groundwater plume in the Biscayne Aquifer. The RWS has operated since May 2018 under a consumptive use permit (13-06251-W) issued by the SFWMD (SFWMD 2017). In the FSEIS, the NRC staff reviewed the groundwater modeling that was used to support the 13-06251-W permit application, as part of the staff's evaluation of the Category 1 issue, "Groundwater Quality Degradation (Plants with Cooling Ponds in Salt Marshes)," and the Category 2 issue, "Groundwater Use Conflicts (Plants That Withdraw More Than 100 Gallons per Minute)" (NRC 2019a, Section 4.5.1.2). The NRC staff incorporates herein by reference the information and analyses presented in Section 4.5.1.2 of the FSEIS for these two issues.

In the FSEIS, the NRC staff concluded that operation of the RWS would not result in any interference with existing permitted uses of groundwater and would not affect natural resources, based on the continued regulatory oversight by other authorities and enforcement of the terms of the 2015 Miami-Dade County Consent Agreement and the 2016 FDEP Consent Order. Accordingly, the staff concluded that groundwater use conflicts from RWS and marine well operations would be SMALL for the Biscayne Aquifer and that the impacts on groundwater quality would also be SMALL. In this EIS, the NRC staff considered additional information that was not available when the FSEIS was published, concerning two extraction wells that became operational following the staff's issuance of the FSEIS.

Specifically, in early 2020, two existing UIC test extraction wells (UICPW-1 and UICPW-2) were activated with a combined rate of up to 3.5 MGD, to remove hypersaline groundwater from beneath the CCS. The UIC test extraction wells were drilled to the base of the Biscayne Aquifer (a surficial aquifer extending from land surface to approximately 140 ft deep at the Turkey Point site) and were constructed in a similar manner as the recovery wells. The UIC test extraction wells are colocated with the deep injection well used for disposal of extracted hypersaline water (Permit No. 0293962-004-UO/MM). The deep injection well discharges to the Boulder Zone aquifer (about 3,000 ft below land surface). The rated capacity of the deep injection well was increased to 18.6 MGD to account for UIC test extraction withdrawals. As discussed in Section 4.5.3 of the FSEIS, the NRC staff concluded in the final EIS for the Turkey Point Units 6 and 7 combined licenses (NUREG-2176) (NRC 2016) that groundwater quality impacts from deep well injection into the Boulder Zone would be SMALL. The NRC staff incorporates those findings into this EIS by reference.

Like the marine wells, the UIC test extraction wells withdraw water that has chloride concentrations greater than 19,000 mg/L (i.e., saline or saltwater) and, therefore, do not require a consumptive use permit (FPL 2022a). Because the UIC test extraction wells remove hypersaline groundwater as part of an approved groundwater remediation program, the NRC staff concludes that their use would not degrade groundwater quality.

The FSEIS also concluded that the potential for groundwater use conflicts in the Biscayne Aquifer from FPL's groundwater withdrawals would be SMALL. This conclusion accounted for

the use of the permitted RWS wells, as well as the emergency use of the marine wells, but did not consider the UIC test extraction wells that were activated following the issuance of the FSEIS. In this EIS, the NRC staff considers new information concerning the environmental impacts of the UIC test extraction wells. The UIC test extraction wells are located approximately 1 mile east of the RWS-4 well (see Figure 2-1) and their withdrawals (3.5 MGD) represent an increase in extraction of approximately 25 percent above the existing 15 MGD allocation approved for the RWS. There are no registered water wells within a 2-mile band around the FPL site boundary (FPL 2018f); therefore, the NRC staff does not expect any substantial groundwater use conflict to result from the additional UIC test extraction well withdrawals.

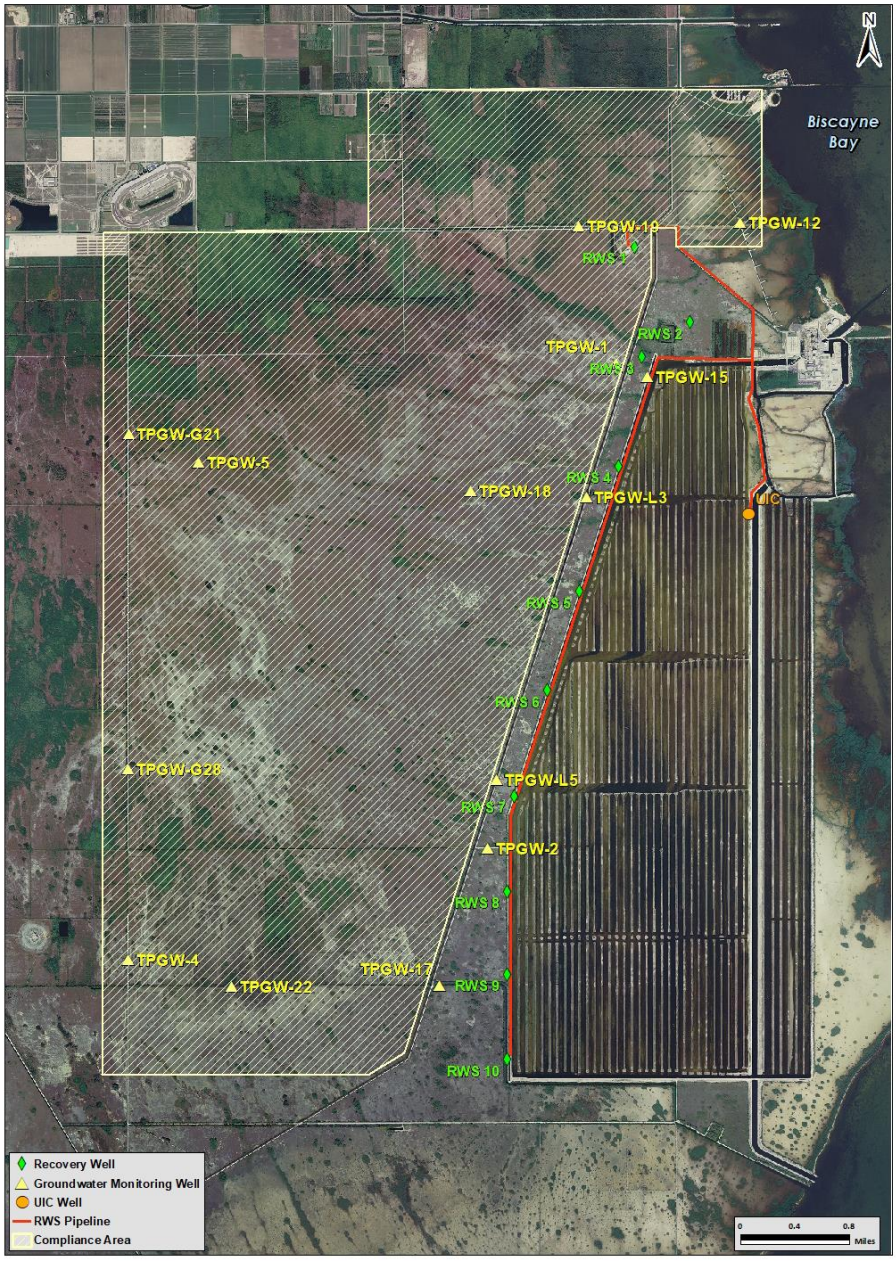


**Figure 2-1 Compliance Area, RWS and Monitoring Wells West and North of the CCS (Source: FPL 2022d)**

This determination is consistent with the updated groundwater modeling predictions (which include RWS and UIC test extraction well pumping rates of 15 and 3 MGD, respectively) presented in Appendix I of ER Supplement 2 (FPL 2022a). This modeling predicts that the 0.1 ft drawdown contour within the Biscayne Aquifer extends approximately 1.5 miles west of the CCS in year 5 of the remediation period, and this contour does not intersect with any offsite water supply wells completed in the Biscayne Aquifer.

Based on the above evaluation, the NRC staff concludes that both the potential for groundwater use conflicts and the potential for groundwater quality degradation from FPL's groundwater withdrawals during the SLR term, would be SMALL for the Biscayne Aquifer.

#### *2.8.2.2 Upper Floridan Aquifer*

The existing Turkey Point Unit 5 production well system and the freshening well system withdraw water from the UFA. The 14 MGD (daily average) withdrawals from the UFA for CCS freshening were initially authorized in 2016 by Turkey Point Site Certification PA03-45E (FDEP 2016a). Although FPL initially believed that the freshening actions that it had taken were effective in moderating CCS salinity, it later determined that additional freshening was needed to replace evaporative losses during drought periods and to achieve and maintain an average annual salinity at or below 34 practical salinity units (psu), as required by the 2016 FDEP Consent Order. Therefore, FPL filed an application to modify Turkey Point Site Certification PA03-45E in October 2020 to add an additional freshening well (F-7) (see Figure 2-2) and to increase the daily average UFA withdrawal for CCS freshening by an additional 16 MGD (FPL 2020a). This additional allocation was not evaluated by the NRC staff in the FSEIS and represents new information that is considered in this section of the site-specific EIS. FPL did not request any changes to the Turkey Point Site Certification for the Unit 5 production well system.

In support of its request to modify Turkey Point Site Certification PA03-45E, FPL used the East Coast Floridan Aquifer System Model – Phase 2 (ECFAS2) to evaluate potential aquifer drawdown and impacts on other groundwater users from the proposed groundwater use. This same modeling approach was used by FPL to evaluate drawdown in the UFA in support of withdrawals for CCS freshening, as described in the FSEIS. The model, which was originally developed for SFWMD water use permitting, was revised by FPL's contractor for site-specific conditions and recalibrated using two site-specific aquifer performance tests (FPL 2020a). The resulting calibrated groundwater model was used to assess the impact and cumulative impact from the proposed 16 MGD freshening withdrawal combined with all other existing authorized UFA allocations. The NRC staff reviewed the related modeling report included in FPL's Turkey Point Clean Energy Center Power Plant Site Certification No. PA 03-45 Petition for Modification F (FPL 2020a). The report indicates that the extent of drawdown resulting from the additional 16 MGD of average daily use, as defined by the 1 ft drawdown contour, encompasses six non-FPL existing legal UFA users.

The maximum predicted additional drawdown for non-FPL offsite wells is 2.94 ft for the proposed withdrawal. This prediction is for the North Largo Utilities wellfield, which is located approximately 9.2 miles southeast of recovery well F-3. The modeling report also predicts approximately 19 feet of additional drawdown to occur on the Turkey Point site at CCS salinity reduction well F-3. Given that there are hundreds of feet of developable head in the UFA, the NRC staff concludes that the proposed allocation of 16 MGD freshening withdrawal combined with all other existing authorized UFA allocations will not interfere with existing legal users' ability to pump water at their permitted rates.


**Figure 2-2 FPL Freshening Well Locations (Source: FPL 2020a)**

Further, the modeling results indicate that operation of the FPL freshening well system is unlikely to result in changes to vertical and lateral flows sufficient to change regional water quality. Local changes in water quality, however, may occur over time due to upconing of deeper saline water due to individual and cumulative UFA withdrawals, as documented by SFWMD modeling (SFWMD 2018). However, such changes are expected to be minor and are not expected to be exacerbated by the proposed increase in UFA freshening withdrawals (FPL 2020a). Moreover, although the UFA is designated as an underground source of drinking water, it is too saline to be used for drinking water without treatment (NRC 2019a).

Turkey Point Site Certification PA03-45F was issued by the FDEP on October 19, 2021, increasing the UFA annual allocation for freshening to 10,950 million gallons (average rate of 30 MGD) with a maximum monthly allocation of 1,033.6 million gallons (FDEP 2021).

In accordance with the modified site certification and associated Conditions of Certification for the Turkey Point site (FDEP 2021), FPL is required to mitigate harm to offsite groundwater

users (either related to water quantity or quality) as well as to offsite water bodies, land uses, and other beneficial uses. As necessary, the SFWMD can order FPL to reduce withdrawals or undertake other mitigative actions (FDEP 2021).

FPL performs ongoing monitoring and reporting on multiple aspects of its water use. This includes reporting water use via a SFWMD-approved accounting system to ensure that FPL's use is within its permitted allocation. Additionally, monitoring is required to ensure that water quality is appropriate for its intended use (e.g., freshening), that water use is having the anticipated impact (e.g., reducing and moderating salinity within the CCS), and that water use is not harming existing legal uses, natural resources, and offsite land uses (FDEP 2022b; SFWMD 2017).

Based on the above evaluation of FPL's groundwater withdrawals during the SLR term, the NRC staff concludes that the potential for groundwater use conflicts would be MODERATE and the potential for groundwater quality degradation would be SMALL for the UFA.

### 2.8.3 Groundwater Quality Degradation (Plants with Cooling Ponds in Salt Marshes)

The issue of groundwater quality degradation (for plants with cooling ponds in salt marshes) was evaluated as a generic Category 1 issue in Section 4.5.1.2 of the FSEIS. In addition, in Section 4.5.1.2 of the FSEIS (NRC 2019a), the NRC staff considered any new and potentially significant information that might have warranted reconsideration of the LR GEIS generic finding. In this section of the current EIS, the staff evaluates this issue on a site-specific basis.

This issue considers the situation in which groundwater quality and potential beneficial use may become degraded as a result of the migration of contaminants discharged to cooling ponds or similar impoundments from the plant's cooling water system. The concentration of dissolved chemicals, including those naturally occurring in the effluent, increases relative to that of the concentration of chemicals in the makeup water as water passes through the plant's cooling system. These increases include total dissolved solids (TDS) primarily due to water losses to evaporation, heavy metals released from the cooling system components, and chemical additives introduced to prevent biofouling.

Because cooling ponds or impoundments are generally unlined, the water in them can hydraulically interact with underlying shallow groundwater systems and may create a groundwater mound with water originating from the cooling ponds or impoundments. In coastal regions, including salt marshes, the groundwater is already limited in its use because it is naturally brackish (e.g., it has a TDS level of above 1,000 milligrams per liter [mg/L]).

The FSEIS discusses this issue in detail. As described in the FSEIS (NRC 2019a), the plant's CCS has no direct intake or discharge to any surface water, including that of Biscayne Bay. The CCS is sustained by precipitation falling directly on the CCS, groundwater inflow from the Biscayne Aquifer, and inputs from the freshening wells. As the FSEIS further explains, the Biscayne Aquifer is classified as both Class G-III (nonpotable use, with TDS levels of 10,000 mg/L or greater) beneath the Turkey Point site and CCS, and Class-II (potable) to the west of the CCS. Seawater intrusion in the Biscayne Aquifer had progressed inland westward beyond the Turkey Point site prior to construction of the CCS in the 1970s. West of the saltwater interface inland is a major well field where the Biscayne Aquifer serves as the major public water supply source for the region, including Miami-Dade County and the Florida Keys.

As discussed in the FSEIS, CCS salinity increased gradually over time from approximately 34 psu in the early 1970s (about equal to that of the nearby Biscayne Bay) to a maximum salinity of about 90 psu in portions of 2014 and 2015 (NRC 2019a). A hypersaline plume developed in the Biscayne Aquifer beneath the CCS and moved vertically downward in the aquifer and then migrated laterally beyond the CCS boundaries. The operation of the CCS contributed to the degradation of groundwater quality beyond the CCS structure and Turkey Point site boundaries, and the affected water migrates to the west toward areas where groundwater within the Biscayne Aquifer is of sufficient quality to serve as a potable water supply (NRC 2019a).

In the FSEIS, the NRC staff also discussed various regulatory and enforcement initiatives pursued by local and State governmental authorities, including the 2015 Miami-Dade County Consent Agreement, the 2016 FDEP Consent Order, and the SFWMD Supplemental Agreement. In its ER Supplement 2, FPL indicates that in accordance with these requirements and the consolidated conditions documented in the updated Conditions of Certification report (FDEP 2022a), it continues to adhere to applicable State and local governmental requirements. These include maintaining the CCS salinity and nutrient management program, recovering hypersaline groundwater from the Biscayne Aquifer, and conducting specified monitoring programs (FPL 2022a). The CCS salinity and nutrient management programs include adding lower salinity groundwater pumped from the UFA to the CCS, improving CCS thermal efficiency, and vegetation management.

#### *2.8.3.1 Salinity and Nutrient Management Program*

A critical part of the CCS salinity reduction measures involves the use of water from the UFA. An increase of the UFA allocation from 5,110 to 10,950 million gallons per year (average rate of 30 million gallons per day) with a maximum monthly allocation of 1,033.6 million gallons was granted for Turkey Point in October 2021.

FPL conducts extensive vegetation management on CCS berms to reduce nutrient inputs to the CCS and uses berm sediment BMPs to prevent nutrients in berm sediment from entering the cooling canals. Additionally, nutrients are removed from the CCS by implementing a nutrient-rich foam capture and effluent disposal system. Nutrients are sequestered naturally by approximately 7 ac of planted seagrass. Nutrients, including ammonia and phosphorus, are monitored in the groundwater around the CCS. Concentrations of ammonia tend to fluctuate relative to other parameters; the highest levels were observed in proximity to the RWS wells in March 2022. Total phosphorous levels that were found recently were in a range that is similar to that observed in the shallow Biscayne Aquifer (FPL 2022b).

The annual average salinity of the CCS has decreased from the high of 82.5 psu observed from June 2014 through May 2015 to 39.2 psu during June 2020 through May 2021 (EEI 2016 a; FPL 2021a). Figure 2-3 presents a time series of the salinity (average of all stations) in the CCS over the past 7 years (2015–2022) and illustrates a declining trend during that period. The first full year of freshening activities began in 2017. The annual average salinity for the June 1, 2021, to May 31, 2022, reporting period was 36.1 psu, which is the lowest annual average value since 1977 (FPL 2022c). This annual average of salinity in the CCS is near the daily average salinity observed in Biscayne Bay east and south of Turkey Point, which has fluctuated from a low of 12.3 psu to a high of 47.5 psu since bay monitoring adjacent to Turkey Point began in 2010 (FPL 2022a). FPL attributes the reduced salinity to freshening activities via water additions from UFA pumping as well as above-average rainfall (approximately 20 percent higher) for the reporting period (FPL 2022b, FPL 2022d). The amount of freshening water added to the CCS during the 2021-2022 reporting period was less than half of the authorized UFA allocation (FPL 2022d).


**Figure 2-3 CCS Salinity Time Series (Source: FPL 2022b)**

As discussed in the FSEIS, the 2016 FDEP Confirmatory Order requires FPL to achieve an average annual CCS salinity of 34 psu or less. The CCS salinity data indicate that significant progress has been made toward achieving the 34 psu objective. Based on the available data, the NRC staff concludes that CCS operation during the SLR term is unlikely to result in substantial contributions to the hypersaline groundwater plume, if freshening activities and CCS salinity are maintained at their current levels.

#### *2.8.3.2 Recovery of Hypersaline Groundwater from the Biscayne Aquifer and Monitoring*

The RWS, including 10 groundwater recovery wells, has operated since May 2018 (FPL 2022d). In February 2020, FPL initiated operation of two UIC test extraction wells to remove hypersaline groundwater from the Biscayne Aquifer beneath the CCS (FPL 2022a). A total of approximately 23 billion gallons of hypersaline groundwater and more than 9 billion pounds of salt have been extracted from the Biscayne Aquifer since RWS operations began (FPL 2022d).

The results of FPL's 2022 continuous surface electromagnetic mapping (CSEM) survey indicate that the volume of hypersaline water in the 2016 FDEP Consent Order compliance area (see Figure 2-1) has been reduced by 67 percent since remediation began in 2018 (FPL 2022d).

The 2015 Miami-Dade County Consent Agreement and the 2016 FDEP Consent Order define hypersaline groundwater as groundwater with a chloride concentration greater than 19,000 milligrams per liter (mg/L). Figure 2-4 through Figure 2-6 show comparative positions of the 19,000 mg/L chloride contour for the 2018 baseline conditions and 2022 conditions, for the shallow, middle, and deep monitoring well horizons. Chloride contour maps were generated, using monitoring well analytical data augmented with CSEM data (FPL 2022d). These figures indicate that the hypersaline interface is being retracted closer to the CCS boundary for all three depth horizons. FPL states (FPL 2022d) that there is some uncertainty in these chloride concentration estimates in some areas due to spatial distances between the monitoring wells, differing depths of well screens, discrepancies between the CSEM and laboratory analytical results, and the hydraulic continuity of the aquifer, among other factors.

As discussed above, FPL continues to implement various programs to address the salinity and nutrients in the CCS and hypersaline groundwater in the Biscayne Aquifer. The recent monitoring data show that progress has been made in resolving these issues, including a substantial decrease in CCS salinity, recovery of hypersaline groundwater, and halting the westward advance of the saltwater interface in the Biscayne Aquifer.

The goal of the RWS is to retract the hypersaline groundwater to within the FPL site boundary. Initial modeling of the RWS, discussed in Section 4.5.1.2 of the FSEIS (NRC 2019a), had indicated that the hypersaline groundwater plume would be retracted to within the CCS boundary prior to the start of the SLR term (i.e., by about 2028). However, new information about the performance of the RWS obtained since the FSEIS was prepared indicates that while the RWS has been successful in retracting the hypersaline plume, it has not been as successful as originally forecasted.

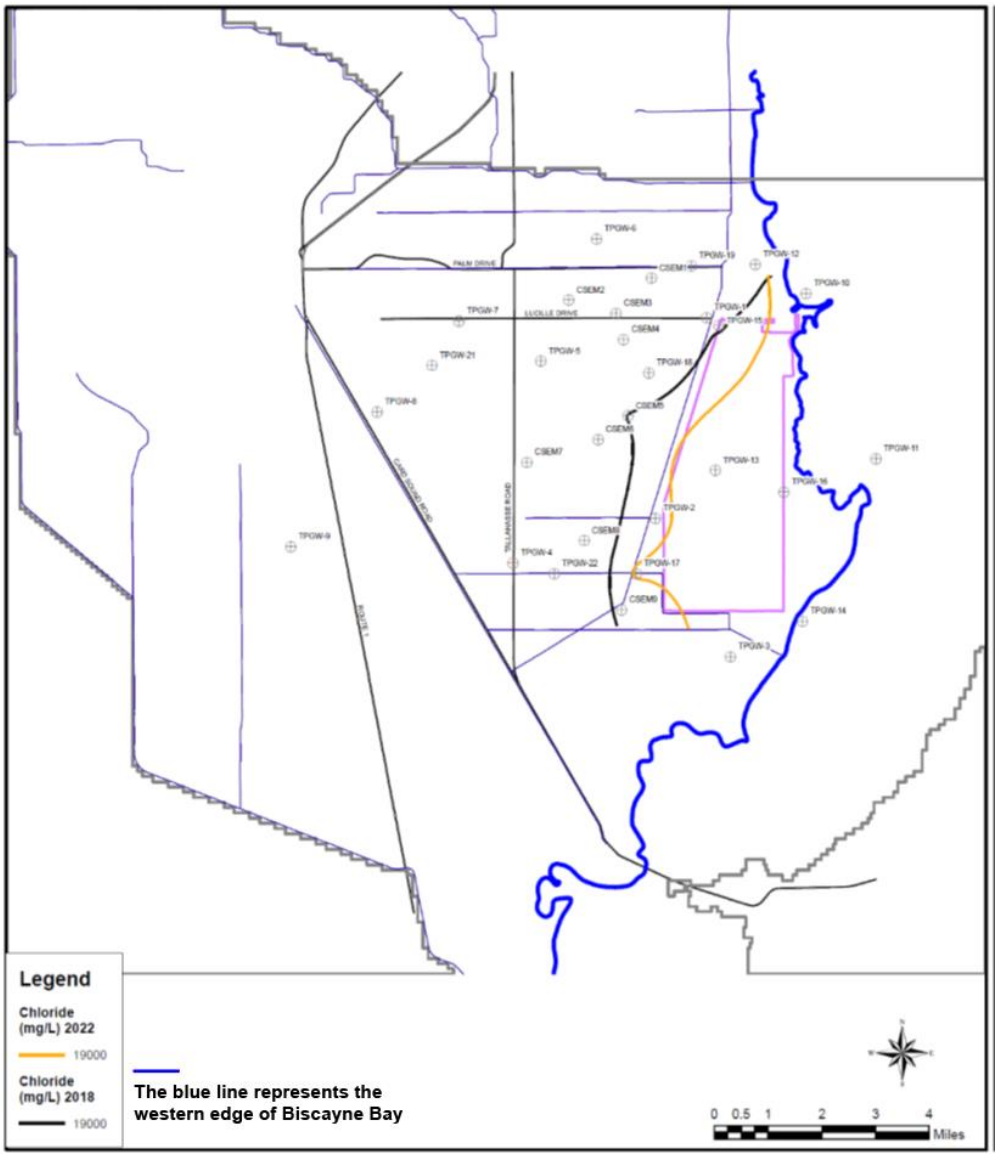


**Figure 2-4 Comparison of the 2018 and 2022 Inland Extent of Hypersaline Groundwater (19,000 mg/L Chloride Isochlor) in the Shallow Horizon (Source: FPL 2022d)**

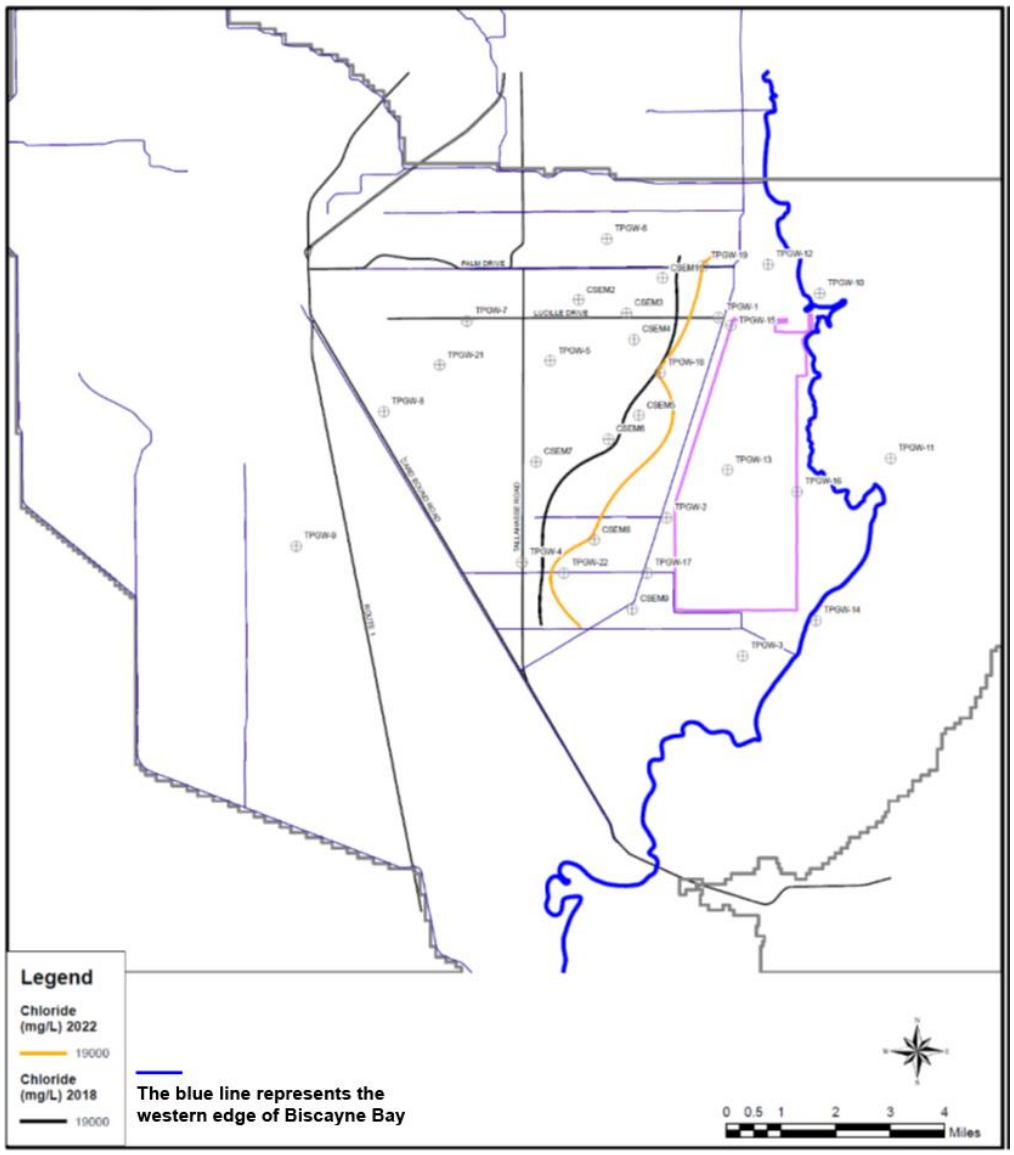


**Figure 2-5 Comparison of the 2018 and 2022 Inland Extent of Hypersaline Groundwater (19,000 mg/L Chloride Isochlor) in the Middle Horizon (Source: FPL 2022d)**

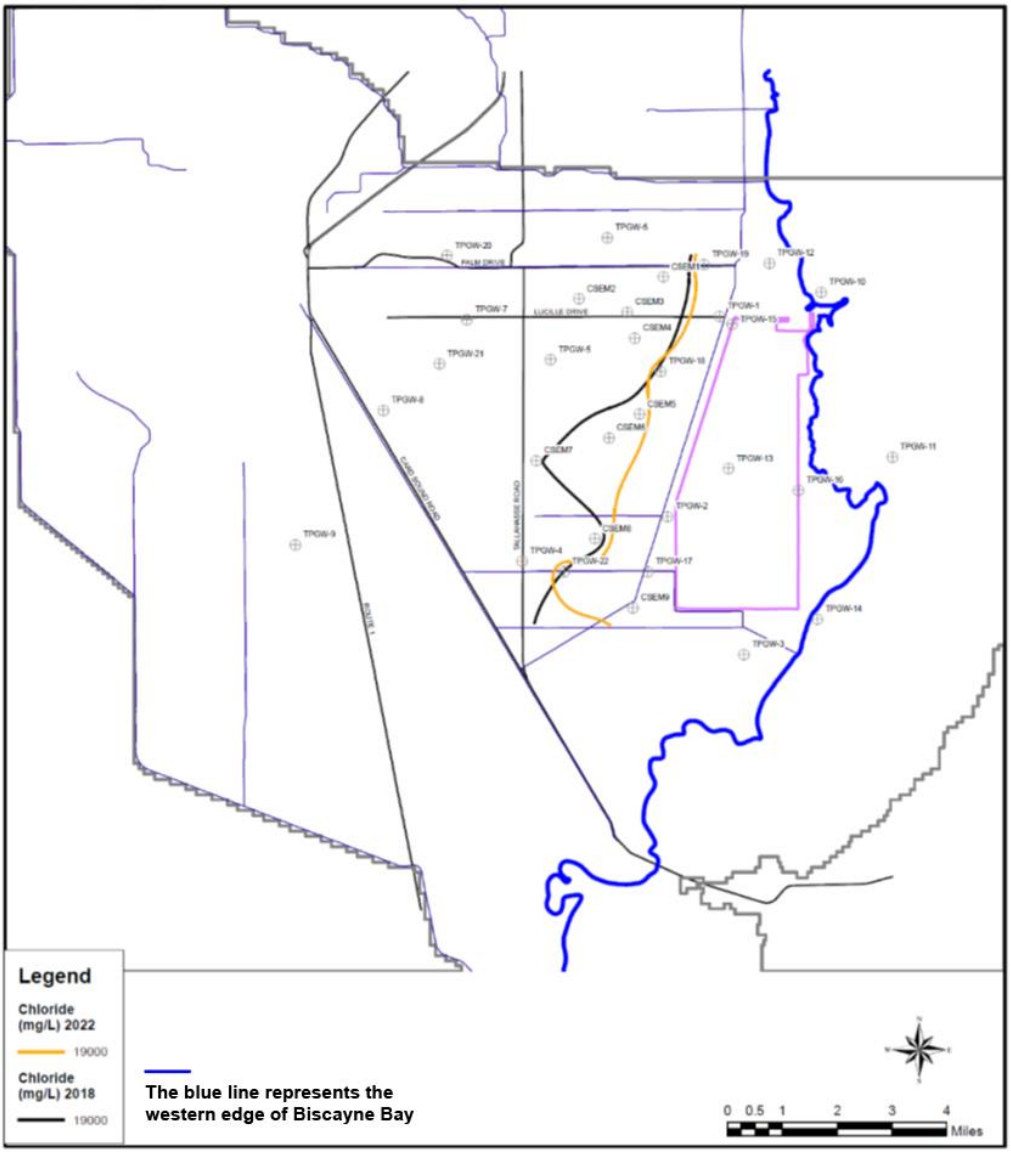


**Figure 2-6 Comparison of the 2018 and 2022 Inland Extent of Hypersaline Groundwater (19,000 mg/L Chloride Isochlor) in the Deep Horizon (Source: FPL 2022d)**

Specifically, FPL updated its variable density flow and salt transport model, which now includes 17 layers (FPL 2022d). This update was informed by data collected during operation of the RWS. The updated modeling indicates that within 10 years of commencing operation of the RWS (i.e., by year 2028) the RWS will fully retract the hypersaline plume interface in the upper two-thirds of the Biscayne Aquifer to within the FPL site boundary (see Figure 2-7 and Figure 2-8). However, as presented in Figure 2-9, the modeling predicts that in the lower portions of the aquifer, some retraction of the hypersaline plume interface will occur in the northern areas, but the westward expansion will only slow or halt after 10 years of RWS operation (FPL 2022d). This updated modeling, along with recent data (see Figure 2-6), suggests that the hypersaline plume will persist, to some extent, in the lower portions of the Biscayne Aquifer outside the FPL site boundary prior to the SLR period.

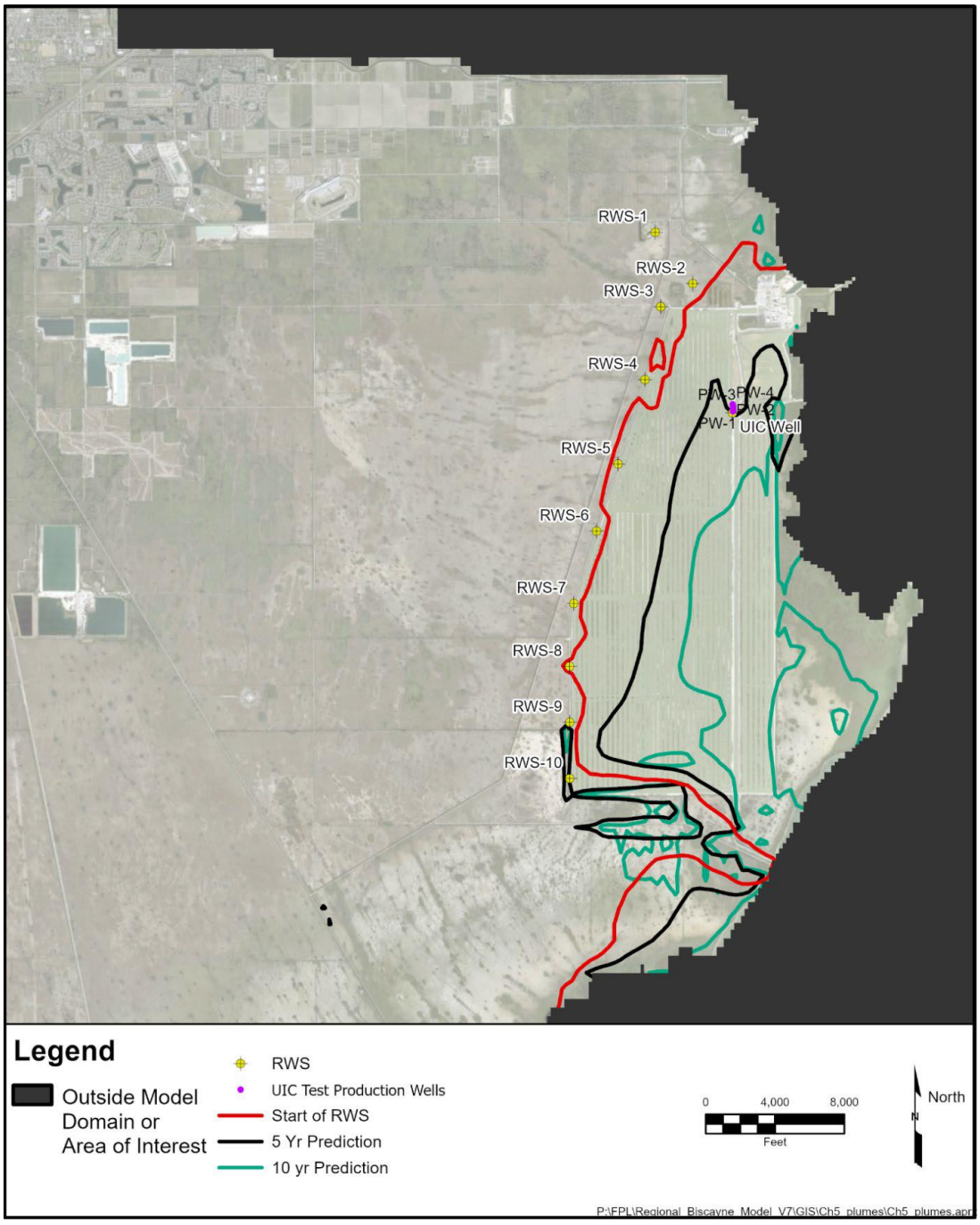


**Figure 2-7 Location of the Initial, Year 5, and Year 10 Hypersaline Interface in Model Layer 4 (Source: FPL 2022d)**

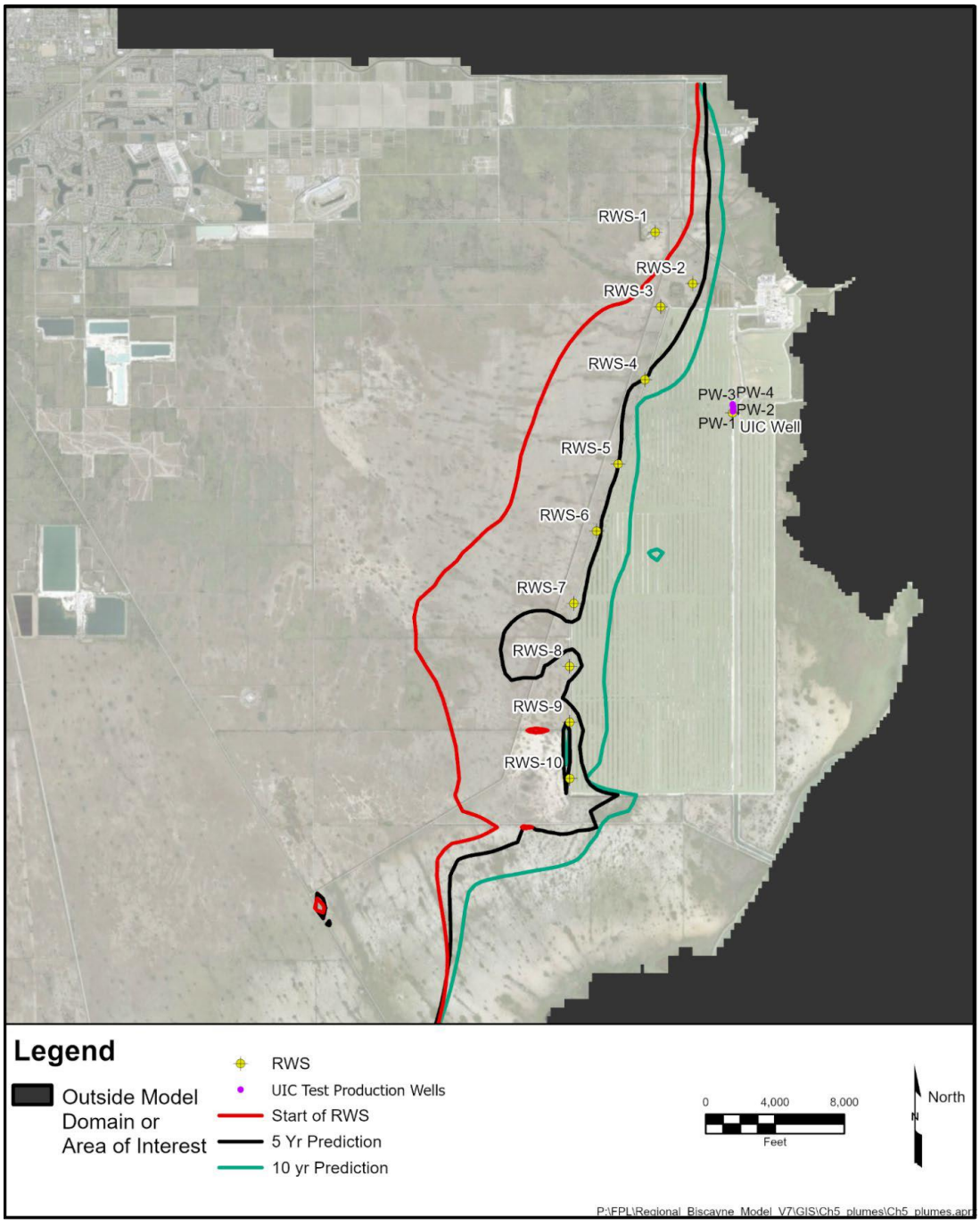


**Figure 2-8 Location of the Initial, Year 5, and Year 10 Hypersaline Interface in Model Layer 9 (Source: FPL 2022d)**

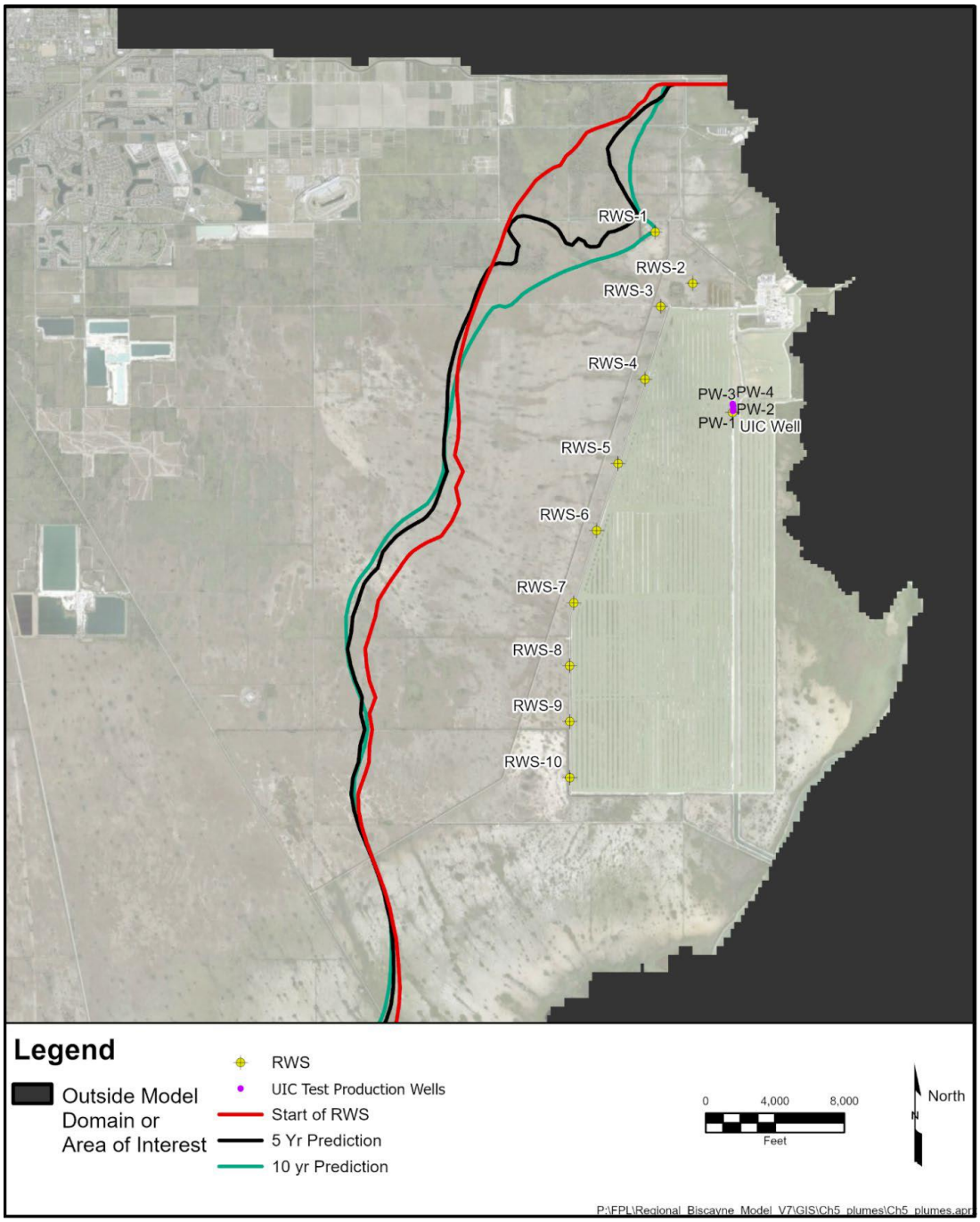


**Figure 2-9 Location of the Initial, Year 5, and Year 10 Hypersaline Interface in Model Layer 16 (Source: FPL 2022d)**

As shown in Figure 2-4, based on 2022 CSEM and groundwater monitoring well data, the hypersaline groundwater plume in the shallow zone has almost been fully retracted to within the FPL site boundary, while Figure 2-6 indicates that hypersaline groundwater plume in the deep zone extends approximately 0.5 to 1.5 miles west of the L-31E canal. The NRC staff notes, however, that the updated modeling tends to underestimate the extent of the hypersaline interface in the shallow layers and overestimate its extent in deeper layers, relative to the CSEM and groundwater monitoring well data (FPL 2022d).

As discussed in the FSEIS, there are no registered groundwater supply wells within a 2-mile band of the FPL site boundary (FPL 2018f). Relative to the Turkey Point site, the nearest mapped water supply wells are located about 5 miles west of the western boundary of the CCS and are used to support mining operations (FDOH 2023). The nearest public water supply wells are located about 6 miles from the northwest corner of the CCS and approximately 7 miles from the center of the Turkey Point plant complex (FDOH 2023, MDC 2006, NRC 2016).

Based on the results obtained to date, it is likely that, with continued freshening of the CCS and continued operation of the RWS to halt and retract the westward migration of that plume, the operation of Turkey Point Units 3 and 4 during the SLR term would not worsen the hypersaline groundwater plume outside the plant boundary, would not destabilize the groundwater resource, and would not adversely affect the beneficial uses of groundwater offsite by existing users. The NRC staff notes, however, that FPL has not presented predictive modeling results that extend to either the start or the expiration of the SLR term, which precludes the staff from reaching a definitive conclusion about the likely extent of hypersaline plume retraction during the SLR term. At the same time, the NRC staff notes that the SLR term would not commence until 2032 and 2033 for Turkey Point Units 3 and 4, respectively; therefore, a substantial period of time exists to allow the ongoing (or potentially revised) groundwater remediation activities to improve groundwater quality prior to the start of the SLR term.

In sum, if FPL can retract and maintain the hypersaline plume to within the FPL site boundary prior to the SLR term, the impacts on groundwater quality from the CCS operations during the SLR term would be SMALL. However, because some uncertainty exists about whether FPL will be able to retract the hypersaline groundwater plume to within the FPL site boundary prior to the SLR term, the impact could be MODERATE. Accordingly, the staff concludes that, depending on FPL's success in retracting the hypersaline plume, the impacts on groundwater quality from the CCS operations during the SLR term would be SMALL to MODERATE.

## 2.9 Terrestrial Resources

The following sections address the site-specific environmental impacts of Turkey Point SLR on five environmental issues related to terrestrial resources.

### 2.9.1 Exposure of Terrestrial Organisms to Radionuclides

This issue concerns the potential impacts on terrestrial organisms caused by exposure to radionuclides related to routine radiological effluent releases. In the following discussion, the NRC staff summarizes the manner in which this issue has been addressed historically, and then presents a site-specific evaluation of the issue for Turkey Point SLR.

Radionuclides may be released from nuclear power plants into the environment through several pathways. During normal operations, nuclear power plants can release gaseous emissions that deposit small amounts of radioactive particulates in the surrounding environment. Gaseous emissions typically include krypton, xenon, and argon (which may or may not be radioactive), tritium, isotopes of iodine, and cesium. Emissions may also include strontium, cobalt, and chromium. Radionuclides may also be released into water as liquid effluent. Terrestrial plants can absorb through their roots radionuclides that enter shallow groundwater or surface waters. Animals may experience exposure to ionizing radiation through direct contact with air, water, or other media; inhalation; or ingestion of contaminated food, water, or soil.

The 1996 LR GEIS (NRC 1996) did not address this issue. In 2007, the International Commission on Radiation Protection (ICRP) issued revised recommendations for a system of protection to control exposure from radiation sources (ICRP 2007). The recommendations included a section about the protection of the environment in which the ICRP found that a clearer framework for assessing non-human organisms was warranted. The ICRP indicated that it would develop a set of reference animals and plants as the basis for relating exposure to dose, and dose to radiation effects, for different types of organisms. This information would then provide a basis from which agencies and responsible organizations could make policy and management decisions. Subsequently, the ICRP developed and published a set of 12 reference animals and plants (ICRP 2008, 2009). They include a large and small terrestrial mammal, an aquatic bird, and a large and small terrestrial plant, among others. The ICRP also issues publications and information related to radiological effects and radiosensitivity in non-human biota (Adam-Guillermin et al. 2018).

In 2009, after the staff conducted a review of the ICRP's 2007 recommendations, the Commission found that there is no evidence that the NRC's current set of radiation protection controls is not protective of the environment (NRC 2009a). For this reason, the Commission determined that the NRC staff should not develop separate radiation protection regulations for plant and animal species (NRC 2009a). The Commission charged the NRC staff with continuing to monitor international developments on this issue and to keep the Commission informed of any such developments. Nonetheless, the NRC addressed the radiological exposure of non-human organisms in the 2013 LR GEIS (NRC 2013a) due to public concern about these impacts at some nuclear power plants.

In the 2013 LR GEIS, the NRC staff adopted the U.S. Department of Energy (DOE) standard for a graded approach for evaluating radiation doses to terrestrial and aquatic biota (DOE 2019). This DOE standard provides methods, models, and guidance that can be used to characterize radiation doses to terrestrial and aquatic biota exposed to radioactive material (DOE 2019). The following DOE guidance dose rates are the levels below which no adverse effects to resident populations are expected:

- riparian animal (0.1 radiation-absorbed dose per day [rad/d]; 0.001 gray per day [Gy/d])
- terrestrial animal (0.1 rad/d) (0.001 Gy/d)
- terrestrial plant (1 rad/d) (0.01 Gy/d)
- aquatic animal (1 rad/d) (0.01 Gy/d).

The NRC staff notes that in 1992, the International Atomic Energy Agency (IAEA 1992) had concluded that chronic dose rates of 0.1 rad/d (0.001 Gy/d) or less do not appear to cause observable changes in terrestrial animal populations. The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) concluded in 1996 and reaffirmed in 2008 that chronic dose rates of less than 0.1 mGy/hr (0.24 rad/d or 0.0024 Gy/d) to the most highly exposed individuals would be unlikely to have significant effects on most terrestrial communities (UNSCEAR 2010).

In the 2013 LR GEIS, the NRC estimated the total radiological dose that the four non-human receptors listed above (i.e., riparian animal, terrestrial animal, terrestrial plant, and aquatic animal) would be expected to receive during normal nuclear power plant operations based on plant-specific radionuclide concentrations in water, sediment, and soils at 15 operating nuclear power plants using the Argonne National Laboratory RESRAD-BIOTA dose evaluation model. The NRC found that total calculated dose rates for all terrestrial receptors at all 15 plants were significantly less than the DOE guideline values. As a result, the NRC anticipated in the 2013

LR GEIS that normal operations of these facilities would not result in negative effects on terrestrial biota. The 2013 LR GEIS concluded that the impact of radionuclides on terrestrial biota from past operations would be SMALL for all nuclear power plants and would not be expected to change appreciably during the initial license renewal period.

The NRC staff did not specifically address the exposure of terrestrial organisms to radionuclides as part of its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), because that issue was not addressed in the 1996 LR GEIS upon which the environmental review relied. Later, however, the 2013 LR GEIS did address the issue generically for initial license renewal of all nuclear power plants and concluded that impacts would be SMALL; the staff adopted that conclusion in the 2013 FSEIS for Turkey Point SLR.

In the following discussion, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

The NRC requires nuclear power plants to maintain a radiological environmental monitoring program (REMP) in accordance with the regulations in (1) 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"; (2) 10 CFR Part 20, "Standards for Protection Against Radiation"; and (3) 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste." In addition, radiological monitoring is required in accordance with plant-specific technical specifications. These provisions collectively require that licensees establish and implement a REMP to obtain data about measurable levels of radiation and radioactive material. The NRC provides guidance to licensees on acceptance methods for establishing and conducting REMPs in Regulatory Guide 4.1, "Radiological Environmental Monitoring for Nuclear Power Plants" (NRC 2009b).

FPL established an REMP before Turkey Point began commercial operations to gather data about background radiation and radioactivity that is normally present in the area. FPL has continued to monitor direct radiation and to sample air, water, sediment, crustaceans, fish, and broadleaf vegetation annually for radionuclides. FPL also samples milk if animals that are used to produce milk products for human consumption are present within 5 mi (8 km) of the site. FDOH personnel collect and analyze REMP samples on behalf of FPL, and the results are reported to the NRC. REMP sampling includes indicator and control locations within a 20 mi (32 km) radius of the plant. The indicator locations are designed to detect any increases or buildup of radioactivity that might occur due to Turkey Point operation. Control locations are farther away to monitor naturally occurring radioactivity. FPL compares monitoring results at indicator and control locations to assess any radiological impacts that Turkey Point operations might be having on the surrounding environment.

Since Turkey Point began operating, REMP results have not indicated any significant radiological impacts on the surrounding environment attributable to Turkey Point operations. As part of its environmental review, the NRC staff reviewed the past 5 years of REMP reports (FPL 2022e, 2021b, 2020b, 2019a, 2018h). During this period, the radionuclide concentrations in air, shoreline, crustaceans, and fish samples was below the lower limit of detection (LLD). Surface water samples yielded detectable tritium in 8 to 16 percent of indicator sample locations each year at levels ranging from 93 to 128 picocuries per liter (pCi/L). Tritium concentrations were consistent with those detected during previous operational years and were all well below the reportable level of 30,000 pCi/L. Broadleaf vegetation samples yielded detectable cesium-

137 at both indicator and control sites at levels ranging from 89 to 102 picocuries per kilogram (pCi/kg). Concentrations were consistent with those detected during previous operational years and were all well below the reportable level of 2,000 pCi/kg. This activity is attributable to a combination of weapons fallout testing 30 to 40 years ago and the 1986 Chernobyl Nuclear Power Plant accident in Chernobyl, Ukraine. Therefore, the detected cesium-137 is background radiation present in the area and is unrelated to Turkey Point operations.

In summary, NRC regulations require nuclear power plants to monitor radiation in the environment and to report the results of such monitoring to the NRC through a REMP. The conduct of REMP monitoring ensures that levels of radiation are below regulatory limits and that any changes in radionuclide concentrations are detected and addressed. To date, FPL has not detected levels of radioactivity attributable to Turkey Point operations that would result in measurable radiological impacts on terrestrial organisms. Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. For these reasons, radiological impacts would be minor and would neither destabilize nor noticeably alter any important attribute of the terrestrial environment during the SLR term. Accordingly, the NRC staff concludes that the exposure of terrestrial organisms to radionuclides due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.9.2 Cooling System Impacts on Terrestrial Resources (Plants with Once-Through Cooling Systems or Cooling Ponds)

This issue concerns the potential impacts of once-through cooling systems and cooling ponds at nuclear power plants on terrestrial resources. Cooling system operation can alter the ecological environment in a manner that affects terrestrial resources. Such alterations may include thermal effluent additions to receiving water bodies, chemical effluent additions to surface water or groundwater, impingement of waterfowl, disturbance of terrestrial plants and wetlands associated with maintenance dredging, disposal of dredged material, and erosion of shoreline habitat. In the following discussion, the NRC staff summarizes the manner in which this issue has been addressed historically, and then presents a site-specific evaluation of the issue for Turkey Point SLR.

The 2013 LR GEIS (NRC 2013a) summarizes the available information about these effects. Many of these effects have only been identified at a small number of nuclear power plants, and these plants have modified plant operation to reduce or eliminate the effects. For instance, heavy metals used in condenser tubing was found to be an issue at two plants and elevated concentrations of these contaminants are toxic to terrestrial organisms. Copper alloy condenser tubes in the cooling systems of these plants resulted in the discharge of copper in these plants' liquid effluent. At one plant, these metals resulted in adverse effects on the morphology and reproduction of resident bluegill (*Lepomis macrochirus*) populations (Harrison 1985). At the other plant, abalone (*Haliotis* species) deaths were attributed to exposure to copper in plant effluents (NRC 1996). Terrestrial wildlife that feed on these aquatic organisms could have also been exposed to elevated copper levels and could have experienced adverse effects. However, these nuclear power plants subsequently replaced their copper alloy condenser tubes with tubes made of different materials (e.g., titanium), which has eliminated these impacts. Similar issues have not been reported at any other nuclear power plants.

The 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that cooling system impacts on terrestrial resources during initial license renewal would be SMALL. The 1996 LR GEIS considered this issue for nuclear power plants with cooling ponds; the 2013 LR

GEIS expanded this issue to include plants with once-through cooling systems. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

The potential cooling system impacts on terrestrial resources relevant to the Turkey Point CCS include those associated with thermal and chemical effluents. All liquid effluents from Turkey Point operations are discharged into the CCS, which does not directly connect to any surface water bodies. Section 3.5.1.3 of the Turkey Point FSEIS for SLR describes surface water discharges in detail. The temperature of the CCS varies in response to factors such as heated water discharged from Turkey Point into the CCS, air temperature, wind, precipitation, Biscayne Aquifer groundwater flowing into and out of the CCS, and water that FPL adds to the CCS from wells to reduce salinity. To a lesser extent, discharges of water into the CCS from the interceptor ditch and the Turkey Point Unit 5 cooling tower blowdown can also affect the temperature of water within the CCS. The CCS serves as the ultimate heat sink to cool Turkey Point Units 3 and 4. In 2014, the NRC established an ultimate heat sink temperature limit for the intake from the CCS of 104 °F (40 °C) (NRC 2014b).

Since 2010, FPL has commissioned Ecology and Environment, Inc. to perform ongoing, semiannual ecological monitoring of the Turkey Point site and surrounding environment as a requirement of the FDEP Conditions of Certification in connection with the Turkey Point extended power uprate and the SFWMD Fifth Supplemental Agreement. With respect to the terrestrial environment, Ecology and Environment, Inc. monitors marsh, mangrove, and tree islands to characterize and observe changes in the ecological characteristics over time. FPL samples freshwater marsh sawgrass within the study area for sawgrass percent cover, sawgrass average height, sawgrass live biomass, annual net primary productivity, sclerophylly (a measure of leaf hardness or toughness), and leaf nutrient and stable isotopic composition. FPL also samples marsh porewater for conductance, temperature, and nutrients (nitrogen, ammonia, and phosphorus). FPL's reports show data that have remained generally consistent since monitoring began and have shown no clear upward or downward trend or differences among transects that can be attributed to the proximity of the transects to the CCS. FPL's ecological monitoring data suggest that the observed changes and fluctuations near Turkey Point are attributable to landscape-scale environmental factors, such as hydroperiod length, overall water depth, and storm surges, and that proximity to the CCS does not noticeably influence marsh ecology. Section 3.6.2 of the FSEIS describes the methods and results of these monitoring efforts in detail. To date, ecological monitoring has not detected evidence of any impacts from the CCS on marshes, mangroves, or tree islands via the groundwater pathway (FPL 2022a).

FPL has also undertaken efforts to improve CCS water quality and thermal conditions. These efforts have further reduced the potential for the CCS to affect the surrounding terrestrial environment. Since 2014, FPL has worked to reduce algae concentrations, improve canal circulation, and increase the inflow of groundwater from the Biscayne Aquifer into the CCS by removing sediment from CCS channels. For a short period of time, to help lower CCS temperatures, freshwater from Canal L-31E, brackish water from the UFA, and saltwater from the Biscayne Aquifer were added to the CCS (NRC 2019a). In 2017, FPL began implementing a Nutrient Management Plan for the CCS. This plan was a requirement of the June 20, 2016, Consent Order between FPL and the State of Florida. Actions under this plan have included

sediment removal from many of the CCS canals, flow management within the CCS, water stage management, and vegetation management (NRC 2019a). As part of this plan, since late 2018, FPL has planted widgeongrass (*Ruppia maritima*) in the CCS to restore previous losses of seagrass due to high salinity levels and unsuitable thermal conditions. FPL has planted more than 100,000 individual plants over a total of 7 ac (2.8 ha) to date (FPL 2022a). Section 3.5.1.4 of the FSEIS further describes the components and requirements of the Nutrient Management Plan.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, cooling system impacts on terrestrial resources from current operations and SLR would be similar. Further, requirements under the 2016 Consent Order and SFWMD Fifth Supplemental Agreement will ensure that potential impacts of the CCS on the surrounding environment are minimized and that conditions in the CCS continue to improve. For these reasons, cooling system impacts would be minor and would neither destabilize nor noticeably alter any important attribute of the terrestrial environment during the SLR term. Accordingly, the NRC staff concludes that the cooling system impacts on terrestrial resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.9.3 Bird Collisions with Plant Structures and Transmission Lines

Tall structures on nuclear power plant sites, such as cooling towers, meteorological towers, and transmission lines, create collision hazards for birds that can result in their injury or death. Throughout the United States, millions of birds are killed each year when they collide with human-made objects, including buildings, windows, vehicles, transmission lines, communication towers, wind turbines, cooling towers, and numerous other objects (Erickson et al. 2001). Associated bird mortality is of concern if the stability of the population of a species is threatened or if the reduction in numbers within any bird population significantly impairs its function within the ecosystem.

The 2013 LR GEIS (NRC 2013a) summarizes the results of bird mortality surveys at several nuclear power plants. In the LR GEIS, the NRC staff found that the available data about bird collision mortality associated with nuclear power plant cooling towers and other structures suggest that nuclear power plants cause a small number of bird mortalities. A large percentage of these mortalities occur during the spring and fall migratory periods and primarily involve songbirds migrating at night. Natural draft cooling towers appear to be the structures that pose the largest collision risk at nuclear power plant sites. Operating cooling towers appear to detract birds; the vapor plume, noise, or lighting may mitigate the risk of bird collision. Data about bird injuries are not available, but the NRC staff assumes that some birds that collide with nuclear power plant structures are injured and either die later or suffer reduced fitness until they recover. The relatively few nuclear power plants in the United States that have natural draft towers, combined with the relatively low bird mortality at studied sites, indicate that bird populations are unlikely to be measurably affected by collisions with nuclear power plant structures and that the contribution of nuclear power plant sites to the cumulative effects of bird collision mortalities in the United States is very small. Both the 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS concluded that the impacts of bird collisions during initial license renewal would be SMALL. The 1996 LR GEIS evaluated this issue as two separate issues; the 2013 LR GEIS consolidated them into one issue. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point

adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

Turkey Point does not have cooling towers. The tallest structures on the Turkey Point site are the containment structures for Turkey Point Units 3 and 4, which are approximately 210 ft (64 m) tall. Transmission lines run 590 ft (180 m) from the turbine building west to the 240 kV switchyard. The site also contains a 197 ft (60 m) meteorological tower. These structures and transmission lines lie within the industrial portion of the site.

FPL maintains a voluntary corporate Avian Protection Plan. This plan adheres to Avian Power Line Interaction Committee and FWS guidelines regarding birds and electrical energy production (APLIC and FWS 2005). It includes guidance on reporting bird mortalities, dealing with bird injuries, nest management, permitting, construction design standards to minimize collision and electrocution, staff training, and mortality risk assessment (FPL 2018f).

In the NRC's Biological Assessment for Turkey Point SLR (NRC 2018), the NRC staff evaluated the risk of federally listed birds colliding with in-scope transmission lines. The NRC staff found that the likelihood of collisions of piping plover (*Charadrius melodus*), Everglades snail kite (*Rostrhamus sociabilis*), and Kirtland's warbler (*Setophaga kirtlandi*) at Turkey Point is extremely small because suitable habitat for the listed birds does not occur near major plant structures or in-scope transmission lines, because the staff is not aware of any known reports or incidents of such collisions, and because FPL maintains an Avian Protection Plan.

Between 2012 and 2021, FPL reported eight bird deaths on the Turkey Point site: one brown pelican (*Pelecanus occidentalis*) (2016), three white pelicans (*P. erythrorhynchos*) (2017 and 2021), one anhinga (*Anhinga anhinga*) (2020), two grackles (*Quiscalus quiscula*) (2020 and 2021), and one green heron (*Butorides virescens*) (2021) (FPL 2022a). FPL only reports birds that are handled, removed, or disposed of by site personnel. Nonetheless, this information indicates that the occurrence of avian collisions with site structures and in-scope transmission lines is very low. None of these mortalities is expected to impair the function of or to affect the stability of these populations within the local ecosystem.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR on birds would be similar. For these reasons, the effects of bird collisions with plant structures and transmission lines would be minor and would neither destabilize nor noticeably alter any important attribute of bird populations during the SLR term. Accordingly, the NRC staff concludes that the impacts of bird collisions with plant structures or transmission lines due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.9.4 Transmission Line Right-of-Way Management Impacts on Terrestrial Resources

This issue concerns the effects of transmission line ROW management on terrestrial plants and animals. Utilities maintain transmission line ROWs so that the ground cover is composed of low-growing herbaceous or shrubby vegetation and grasses. Generally, ROWs are initially established by clear-cutting during transmission line construction and are subsequently maintained by physical (e.g., mowing and cutting) and chemical (e.g., herbicides or pesticides) means. These activities alter the composition and diversity of plant communities and generally result in lower-quality habitat for wildlife. Heavy equipment used for ROW maintenance can crush vegetation and compact soils, which can affect soil quality and reduce infiltration to

shallow groundwater. This is especially of concern in sensitive habitats, such as wetlands. Chemical herbicides can be transported to neighboring undisturbed habitats through precipitation and runoff. Disturbed habitats often favor non-native or nuisance species and can lead to their proliferation. Noise and general human disturbance during ROW management can temporarily disturb wildlife and affect their behaviors, and the presence of ROWs can favor wildlife species that prefer edge or early successional habitats.

Both the 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that the impacts of transmission line ROW management on terrestrial resources would be SMALL during the initial license renewal term. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

The transmission lines within the scope of the Turkey Point SLR review are two lines that extend 590 ft (180 m) from the turbine building west to the 240 kV switchyard that connect the Turkey Point reactor buildings to the switchyard. Figure 3-6 in the FSEIS (NRC 2019a) depicts these lines. Both lines are contained within the industrial use portion of the site. They do not cross any natural areas and vegetation management is not required. Therefore, maintenance of these lines has no discernible effect on ecological resources.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, the effects of transmission line ROW management on terrestrial resources would be minor and would neither destabilize nor noticeably alter any important attribute of plant or animal populations during the SLR term. Accordingly, the NRC staff concludes that the impacts of transmission line ROW management on terrestrial resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.9.5 Effects of Electromagnetic Fields on Flora and Fauna (Plants, Agricultural Crops, Honeybees, Wildlife, Livestock)

This issue concerns the effects of electromagnetic fields (EMFs) on terrestrial plants and animals, including agricultural crops, honeybees, wildlife, and livestock. Operating transmission lines produce electric and magnetic fields, collectively referred to as EMFs. EMF strength at the ground level varies greatly but is generally stronger for higher-voltage lines. Corona is the electrical discharge occurring in air from EMFs; it can be detected adjacent to phase conductors. Corona is generally not an issue for transmission lines of 345 kV or less. Corona results in audible noise, radio and television interference, energy losses, and ozone and nitrogen oxide production. Studies investigating the effects of EMFs produced by operating transmission lines up to 1,100 kV have generally not detected any ecologically significant impact on terrestrial plants and animals.

The 2013 LR GEIS (NRC 2013a) summarizes relevant scientific studies and literature about this topic. In the LR GEIS, the NRC staff found that study results reported in the literature about the effects of EMF on plants and wildlife are somewhat mixed. One study found reduced upward growth of trees. Studies of agricultural crops, including corn, bluegrass, alfalfa, and sunflower, have detected no effects or minor effects that did not ultimately affect germination or crop yield.

One study found that densities of breeding birds under transmission lines were greater than those in adjacent forests, grasslands, or agricultural fields. Other studies have found no measurable effects on birds or other wildlife or have concluded that observed population densities were more highly correlated with habitat type than with proximity to transmission lines. Other studies have observed impacts of EMFs on animals, such as an influence on the development, reproduction, and physiology of certain insects and mammals. Honeybees in hives under transmission lines can suffer increased propolis (a resin-like material produced to build hives) production, reduced growth, greater irritability, and increased mortality resulting from voltage buildup and electric currents within the hives. These effects can be mitigated by keeping bees in moisture-free nonconductive conditions, by shielding hives with a grounded metal screen, or by moving them away from transmission lines. The 2013 LR GEIS (p. 4-80 through 4-84) contains more details about and full citations for these studies. Both the 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS concluded that the impacts of EMFs on flora and fauna during initial license renewal would be SMALL. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

The transmission lines within the scope of the Turkey Point SLR review are two lines that extend 590 ft (180 m) from the turbine building west to the 240 kV switchyard that connect the Turkey Point reactor buildings to the switchyard. Figure 3-6 in the FSEIS (NRC 2019a) depicts these lines. Both lines are contained within the industrial use portion of the site and do not cross any wildlife habitat, agricultural fields, or other natural areas. Because of this, exposure of plants and animals to EMFs created by these lines is minimal.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, the effects of EMFs on flora and fauna would be minor and would neither destabilize nor noticeably alter any important attribute of plant or animal populations during the SLR term. Accordingly, the NRC staff concludes that the impacts of EMFs on flora and fauna due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.10 Aquatic Resources

The following sections address the site-specific environmental impacts of Turkey Point SLR on nine environmental issues related to aquatic resources.

### 2.10.1 Entrainment of Phytoplankton and Zooplankton

Entrainment occurs when organisms pass through the cooling system's screening device and travel through the entire system, including the pumps, condenser or heat exchanger tubes, and discharge pipes (79 FR 48300). Organisms susceptible to entrainment are of smaller size, such as ichthyoplankton, meriplankton, zooplankton, and phytoplankton. During travel through the cooling system, entrained organisms experience physical trauma and stress, pressure changes, excess heat, and exposure to chemicals (Mayhew et al. 2000). Because entrainable organisms generally consist of fragile life stages (e.g., eggs, which exhibit poor survival after interacting with a cooling water intake structure, and early larvae, which lack a skeletal structure and swimming ability), the EPA has concluded that, for purposes of assessing the impacts of a

cooling water intake system on the aquatic environment, all entrained organisms die (79 FR 48300). The NRC staff assessed the site-specific impacts of entrainment of fish and shellfish during the Turkey Point SLR term in Section 4.7.1.1 of the FSEIS (NRC 2019a), with respect to the entrainment of phytoplankton and zooplankton.

Most nuclear power plants were required to monitor for entrainment effects during their initial years of operation. In the 2013 LR GEIS (NRC 2013a), the effects of entrainment on phytoplankton and zooplankton were determined to be of SMALL significance if monitoring indicated no evidence that nuclear power plant operation had reduced or otherwise affected populations of these organisms in the source water body. The 2013 LR GEIS summarizes the results of entrainment monitoring at several nuclear power plants. Based on its review, the NRC staff found in the 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS that nuclear power plants had not noticeably altered phytoplankton or zooplankton abundance near these and other plants and that the impacts of initial license renewal would be similar and SMALL. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR.

Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term. The NRC staff analysis first considers impacts that would be experienced by the aquatic biota in the CCS and then impacts that would be experienced by the aquatic biota in adjacent natural aquatic environments, including Biscayne Bay and Card Sound.

#### *2.10.1.1 Phytoplankton and Zooplankton of the CCS*

Aquatic organisms inhabiting the CCS may be entrained when water is drawn from the CCS into the Turkey Point intake structure. Water from the CCS flows from the canal system into eight intake channels and through (0.37 in.) 9.5 mm mesh intake screens at a rate of 4.48 feet per second (fps) (1.4 meters per second [m/s]). The maximum flow per intake channel is 225,375 gpm (14.2 $m^3$/s) (FPL 2018f; NRC 2019a).

In the early 1970s, researchers conducted field and laboratory studies to determine the effects of entrainment of zooplankton at Turkey Point. These studies contemplated the use of Biscayne Bay as an interim cooling water source until the construction of the CCS was completed, followed by Card Sound as a source of CCS makeup water (AEC 1972). After these studies, the Turkey Point cooling system design was modified so that it did not require withdrawal from or discharge to any natural surface water bodies. Therefore, the results of these studies are not relevant to the Turkey Point cooling system, as it was ultimately constructed. FPL has not conducted any entrainment studies within the CCS since its construction. The CWA does not impose ecological study requirements because the State classifies the CCS as an IWW facility and because the CCS does not directly withdraw from or discharge to any natural surface water bodies.

Due to a lack of studies, the characteristics of the phytoplankton and zooplankton community within the CCS are unknown. Species present within the CCS may include those that were common in the 1970s in Biscayne Bay, from which the CCS was initially filled. These include *Acartia tonsa*, *Paracalanus parvus*, *Tamora turbinate*, *Labidocera scotti*, *Oithona nana*, and *Metis jousseaumei* (AEC 1972). Most of these organisms in the CCS are not at risk of entrainment due to the layout of the system and the large size of the CCS relative to the small area influenced by the Turkey Point intake structure's withdrawal of water. Only those

individuals in the CCS intake canal, specifically, would be at risk of entrainment and only those individuals within the smaller area influenced by the intake velocity are likely to be entrained. Many phytoplankton and zooplankton in the CCS likely spend their lives in the main canals and are never exposed to entrainment risk. In contrast, for a nuclear power plant whose intake draws from a river, migration or movement of organisms past the plant would likely necessitate passage through the zone of the plant intake's influence. For the reasons discussed above, the NRC staff concludes that while entrainment at Turkey Point is likely to affect CCS populations of phytoplankton and zooplankton, only a small portion of those organisms would be susceptible to entrainment at any given time.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR on phytoplankton and zooplankton would be similar. For these reasons, the effects of entrainment of phytoplankton and zooplankton in the CCS would be minor and would neither destabilize nor noticeably alter any important attribute of these populations during the SLR term. Accordingly, the NRC staff concludes that the impacts of entrainment of phytoplankton and zooplankton in the CCS due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

#### *2.10.1.2 Phytoplankton and Zooplankton of the Biscayne Bay*

Aquatic organisms inhabiting Biscayne Bay are not subject to entrainment because there are no surface water connections that allow flow between the waters of Biscayne Bay and the CCS. Thus, phytoplankton and zooplankton in Biscayne Bay and connected water bodies (e.g., Card Sound, the Atlantic Ocean, etc.) never interact with the Turkey Point intake structure. Accordingly, the NRC staff concludes that the issue of entrainment of phytoplankton and zooplankton at Turkey Point during the SLR term does not apply to aquatic organisms in Biscayne Bay.

### 2.10.2 Infrequently Reported Thermal Impacts

This issue concerns the infrequently reported effects of thermal effluents. These effects include cold shock, thermal migration barriers, accelerated maturation of freshwater aquatic insects, and proliferated growth of aquatic nuisance species.

Cold shock occurs when an organism has been acclimated to a specific water temperature or range of temperatures and is subsequently exposed to a rapid decrease in temperature. This can result in a cascade of physiological and behavioral responses and, in some cases, death (Donaldson et al. 2008). Rapid temperature decreases may be caused by natural sources (e.g., thermocline temperature variation and storm events) and anthropogenic sources (e.g., thermal effluent discharges). The magnitude, duration, and frequency of the temperature change, as well as the initial acclimation temperatures of individuals, can influence the extent of the consequences of cold shock on fish and other aquatic organisms (Donaldson et al. 2008). At nuclear power plants, cold shock could occur during refueling outages, reductions in power generation level, or other situations that would quickly reduce the amount of cooling capacity required at the plant. Cold shock is most likely to be observable during the winter. The 1996 LR GEIS reports that cold shock events have only rarely occurred at nuclear power plants. Fish mortalities usually involved only a few fish and did not result in population-level effects. Gradual depowering or shutdown of plant operations, especially in winter months, can mitigate the effects of cold shock.

Thermal effluents have the potential to create migration barriers if the thermal plume covers an extensive cross-sectional area of a river and temperatures within the plume exceed a species' physiological tolerance limit. This impact has been examined at several nuclear power plants, but it has not been determined to result in observable effects (NRC 1996, 2013a).

The 1996 LR GEIS and the 2013 LR GEIS considered that the heated effluents of nuclear power plants could accelerate the maturation of aquatic insects in freshwater systems and cause premature emergence. The maturation and emergence of aquatic insects are often closely associated with water temperature regimes. If insects develop or emerge early in the season, they may be unable to feed or reproduce or they may die because the local climate is not warm enough to support them.

The 1996 LR GEIS and the 2013 LR GEIS also considered that the heated effluents of nuclear power plants could proliferate the growth of aquatic nuisance species. Aquatic nuisance species are organisms that disrupt the ecological stability of infested inland (e.g., rivers and lakes), estuarine, or marine waters (EPA 2022). The 1996 LR GEIS and the 2013 LR GEIS discuss the zebra mussel (*Dreissena polymorpha*) and Asiatic clam (*Corbicula fluminea*), two bivalves that are of particular concern in many freshwater systems because they can cause significant biofouling of industrial intake pipes at power and water facilities. These species are also of ecological concern because they outcompete and lead to the decline of native freshwater mussels. Nuclear power plants that withdraw water from water bodies in which these species are known to occur often periodically chlorinate intake pipes or have other procedures in place to mitigate the spread of these bivalves. There is no evidence, however, that thermal effluent leads to these species' proliferation.

Langford (1983) reported several instances in which wood-boring crustaceans and mollusks, notably "shipworms," have caused concern in British waters. Although increased abundance of shipworms in the area influenced by heated power plant effluents caused substantial damage to wooden structures, the replacement of old wood with concrete or metal structures eliminated the problem. Langford concluded that increased temperatures could enhance the activity and reproduction of wood-boring organisms in enclosed or limited areas, but that elevated temperature patterns were not sufficiently stable to cause widespread effects.

The 1996 LR GEIS and the 2013 LR GEIS concluded that these infrequently reported thermal impacts would be SMALL during the initial license renewal term. The 1996 LR GEIS evaluated these concerns as five issues; the 2013 LR GEIS consolidated them into one issue. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning these issues and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the Turkey Point FSEIS adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

With respect to cold shock, no such events have been reported or are expected at Turkey Point. Therefore, cold shock is not expected to be of concern for Turkey Point SLR.

With respect to thermal migration barriers, there are no surface water connections that allow flow between the CCS and any natural water bodies. Therefore, Turkey Point's thermal effluent does not create barriers to migration or otherwise contribute to changes in the natural distribution of aquatic organisms in the region and this issue is not relevant to Turkey Point SLR.

The potential concerns of accelerated maturation of freshwater aquatic insects and proliferated growth of aquatic nuisance species are not relevant to Turkey Point because the CCS is not a freshwater system. Additionally, shipworms are not of concern at Turkey Point because it does not discharge to coastal waters.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, infrequently reported thermal impacts would be minor and would neither destabilize nor noticeably alter any important attribute of the aquatic environment during the SLR term. Accordingly, the NRC staff concludes that infrequently reported thermal impacts on aquatic resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.3 Effects of Cooling Water Discharge on Dissolved Oxygen, Gas Supersaturation, and Eutrophication

This issue concerns the effects of thermal effluents on dissolved oxygen, gas supersaturation, and eutrophication. Because nuclear power plant effluents are heated, discharged water can change certain biological conditions in the receiving water body in a manner that affects the characteristics of that habitat and the potential suitability of that habitat for local fish, shellfish, and other aquatic organisms.

Aerobic organisms, such as fish, require oxygen, and the concentration of dissolved oxygen in a water body is one of the most important ecological water quality parameters. Dissolved oxygen also influences several inorganic chemical reactions. In general, dissolved oxygen concentrations of less than 3 parts per million (ppm) in warmwater habitats or less than 5 ppm in coldwater habitats can adversely affect fish (Morrow and Fischenich 2000). Oxygen dissolves into water via diffusion, aeration, and as a product of photosynthesis. The amount of oxygen water can absorb depends on temperature; the amount of oxygen that can dissolve in a volume of water (i.e., the saturation point) is inversely proportional to the temperature of the water. Thus, when other chemical and physical conditions are equal, the warmer the water is, the less dissolved oxygen it can hold. Increased water temperatures also affect the amount of oxygen that aquatic organisms need by increasing metabolic rates and chemical reaction rates. The rates of many chemical reactions in water approximately doubles for every 18 °F (10 °C) increase in temperature.

The thermal effluent discharges of nuclear power plants have the potential to stress aquatic organisms by simultaneously increasing these organisms' need for oxygen and decreasing oxygen availability. Aquatic organisms are more likely to experience adverse effects from thermal effluents in ecosystems where dissolved oxygen levels are already approaching suboptimal levels caused by other factors in the environment. This is most likely to occur in ecosystems where increased levels of detritus and nutrients (e.g., eutrophication), low flow, and high ambient temperatures already exist. These conditions can occur during drought conditions or in hot weather, especially in lakes, reservoirs, or other dammed freshwater.

Although the thermal effluents of nuclear power plants may contribute to reduced dissolved oxygen in the immediate vicinity of the discharge point, as the effluent disperses, diffusion and aeration from turbulent movement introduce additional oxygen into the water. As the water cools, the saturation point increases, and the water can absorb additional oxygen as it is released by aquatic plants and algae through photosynthesis, which is a continuously ongoing process during daylight hours. Therefore, lower dissolved oxygen is generally only a concern

within the thermal mixing zone, which is typically a small area of the receiving water body. Many States address thermal mixing zones in State water quality criteria to ensure that mixing zones provide a continuous zone of passage for aquatic organisms. Additionally, the EPA, or authorized States and Tribes, often imposes conditions specifically addressing dissolved oxygen through NPDES permits to ensure that receiving water bodies maintain adequate levels of oxygen to support aquatic life. These conditions are established pursuant to CWA Section 316(a), which requires that regulated facilities operate under effluent limitations that assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving water body.

Rapid heating of cooling water can also affect the solubility and saturation point of other dissolved gases, including nitrogen. As water passes through the condenser cooling system of a nuclear power plant, it can become supersaturated with gases. Once the supersaturated water is discharged in the receiving water body, dissolved gas levels equilibrate as the effluent cools and mixes with ambient water. This process is of concern if aquatic organisms remain in the supersaturated effluent for a long enough period to become equilibrated to the increased pressure associated with the effluent. If these organisms then move into water of lower pressure too quickly when, for example, swimming out of the thermal effluent or diving to depths, the dissolved gases within the affected tissues may come out of solution and form embolisms (bubbles). The resulting condition is known as gas bubble disease. In fish, it is most noticeable in the eyes and fins. Affected tissues can swell or hemorrhage and result in behavioral abnormalities, increased susceptibility to predation, or death. Mortality in fish generally occurs at gas supersaturation levels above 110 or 115 percent (EPA 1986). Aquatic insects and crustaceans appear to be more tolerant of supersaturated water (Nebeker et al. 1981).

The ability to detect and avoid supersaturated waters varies among species. A fish can avoid supersaturated waters by either not entering the affected area or by diving to avoid the onset of supersaturated conditions near the surface. Some species, however, may not avoid supersaturated waters until symptoms of gas bubble disease occur; at that point, some fish may already be lethally exposed. Other species may be attracted to supersaturated waters because it is often warmer (Gray et al. 1983).

The 1996 LR GEIS and the 2013 LR GEIS report cases of fish mortality from gas bubble disease at hydroelectric dams and coal-fired power plants. Typically, gas bubble disease is of concern at facilities where the configuration of the discharge allows organisms to reside in the supersaturated effluent for extended periods of time (e.g., discharge canals that fish can freely enter). However, fish mortality from gas bubble disease has been observed in only one instance in the mid-1970s at a nuclear power plant that is no longer operating.

An early concern about nuclear power plant discharges was that thermal effluents would cause or speed eutrophication by stimulating biological productivity in receiving water bodies (NRC 1996). Eutrophication is the gradual increase in the concentration of phosphorus, nitrogen, and other nutrients in a slow-flowing or stagnant aquatic ecosystem, such as a lake. These nutrients enter the ecosystem primarily through runoff from agricultural land and impervious surfaces. The increase in nutrient content allows algae to proliferate on the water's surface, which reduces light penetration and oxygen absorption necessary for underwater life. The 1996 LR GEIS reports that several nuclear power plants conducted long-term monitoring to investigate this potential effect. No evidence of eutrophication was detected.

The 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that the effects of nuclear power plant cooling water discharge on dissolved oxygen, gas supersaturation, and

eutrophication would be SMALL during the initial license renewal term. The 1996 LR GEIS evaluated these concerns as three issues; the 2013 LR GEIS consolidated them into one issue. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning these issues and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the Turkey Point FSEIS adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

Section 3.7.3 of the FSEIS describes the aquatic community of the CCS. Specifically, it describes a CCS characterization study that Ecological Associates, Inc. performed in 2016. Aquatic sampling identified only four taxa of fish and shellfish within the CCS: sheepshead minnow (*Cyprinodon variegatus*), sailfin molly (*Poecilia latipinna*), eastern mosquitofish (*Gambusia holbrooki*), and mudflat fiddler crabs (*Uca rapax*) (EAI 2017). Sampling yielded three taxa of benthic macroinvertebrates. The polychaete *Capitella capitate* was the most common taxon collected followed by marine oligochaetes (Class Oligochaeta) and midge larvae (Family Chironomidae) (EAI 2017). Because there are no surface water connections that allow flow between the CCS and any natural water bodies, no additional aquatic species can be expected to colonize the CCS.

In the FSEIS, the NRC staff described the current CCS aquatic community as being of low diversity and including only those species that can withstand hot, hypersaline waters with low dissolved oxygen and poor water clarity. Therefore, lowered dissolved oxygen resulting from Turkey Point's thermal effluent is unlikely to noticeably affect the aquatic species present in the CCS. Further, these conditions would only be experienced in the immediate vicinity of the discharge, and fish and other aquatic organisms could swim or move away from this area to escape these conditions. For these reasons and because Turkey Point operations during the SLR term would continue current operating conditions, the NRC staff does not expect reduced dissolved oxygen resulting from Turkey Point's thermal effluent to be of concern during the SLR period.

With respect to gas supersaturation, FPL has not reported any instances of fish kills at Turkey Point or any other information indicating that fish in the CCS may have experienced symptoms of gas bubble disease. Because Turkey Point operations during the SLR term would continue current operating conditions, gas supersaturation resulting from Turkey Point's thermal effluent is not expected to be of concern during the SLR period.

With respect to eutrophication, in 2010, the CCS began experiencing a pronounced ecosystem shift. The average salinity of the CCS increased, water quality and clarity began to degrade, and average surface water temperatures increased. Seagrass colonies began to die off due to salinity- and high temperature-related stress. By 2012, very few seagrass beds remained in the CCS. The subsequent decomposition of the seagrasses released a significant volume of nutrients into the CCS, and the increased nutrient levels facilitated algae blooms, which resulted in high turbidity and degraded water quality. Algae blooms remained local and isolated in 2011 and 2012. In 2013 and 2014, continuously elevated concentrations of algae were observed throughout the CCS. By 2016, no seagrasses remained in the CCS. In 2019 when the NRC issued the FSEIS (NRC 2019a), the CCS was operating as an algal-based, phosphorus-limited system such that the algae life cycle primarily dictated the movement of nutrients in and out of the water column.

In 2017, FPL began implementing a Nutrient Management Plan for the CCS as a requirement of the 2016 Consent Order between FPL and the State of Florida. One component of this plan is for FPL to take the necessary actions to ensure acceptable nutrient levels in the CCS. Section 3.5.1.4 of the FSEIS (NRC 2019a) describes the components and requirements of this plan in detail. FPL's recent monitoring results under this plan indicate that the CCS is no longer in a state of eutrophication. Total nitrogen and total phosphorus collected at CCS monitoring stations from April 2019 through September 2022 show low total phosphorus concentrations (ranging from between 0.01 to 0.05 mg/L) and a significant decline in total nitrogen. Dissolved oxygen concentrations averaged 5.0 mg/L from October 2020 through June 2022. Since September 2021, FPL has documented a clear decreasing trend in chlorophyll-a concentrations, decreased turbidity, and increased water clarity, all of which parallel a decline in algae concentrations. Seagrass plantings have also facilitated these improved conditions. (FPL 2023a)

These changes, along with salinity decreases, appear to be driving the CCS ecosystem toward a new equilibrium characterized by lower algal densities, lower particulate nutrient loads, and improved water clarity. Because FPL is required to continue implementing the Nutrient Management Plan, CCS water quality is expected to continue to improve, and eutrophication is not expected to be of concern during the SLR period.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, the effects of dissolved oxygen, gas supersaturation, and eutrophication would be minor and would neither destabilize nor noticeably alter any important attribute of the aquatic environment during the SLR term. Accordingly, the NRC staff concludes that the effects of dissolved oxygen, gas supersaturation, and eutrophication on aquatic resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.4 Effects of Nonradiological Contaminants on Aquatic Organisms

This issue concerns the potential effects of nonradiological contaminants on aquatic organisms that could occur as a result of nuclear power plant operations. This issue was originally of concern because some nuclear power plants used heavy metals in condenser tubing that could leach from the tubing and expose aquatic organisms to these contaminants. Because aquatic organisms can bioaccumulate heavy metals, even when exposed at low levels, this can cause toxicity in fish and other animals that consume contaminated organisms. Section 3.9.2 of the 2013 LR GEIS (NRC 2013a) describes instances in which copper contamination was an issue at operating nuclear power plants. Heavy metals have not been found to be of concern other than in these few instances. In all cases, the nuclear power plants eliminated leaching by replacing the affected piping, and these changes were implemented during the initial operating license terms. The NRC staff has not identified this issue to be of concern during any license renewal reviews to date.

The 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that the effects of nonradiological contaminants on aquatic organisms would be SMALL during the initial license renewal term. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning these issues and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's

conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

Section 2.7.2 of the FSEIS addresses the discharge of metals in cooling system effluent. As explained in that section, Turkey Point's NPDES permit establishes allowable levels of zinc, copper, and iron in wastewater discharges, including stormwater, through two internal outfalls into the CCS. The permit requires FPL to sample and report levels of these metals to the FDEP to demonstrate compliance. Additionally, in 2022, the FDEP instituted a new condition in the NPDES permit that requires FPL to implement a Best Management Practices Plan to prevent or minimize the generation and the potential for the release of pollutants, including mercury, copper, iron, zinc, and nutrients, from plant operations (including spillage, leaks, and material and waste handling and storage activities) to wastewater and stormwater in the CCS. The NRC staff reviewed FPL's NPDES monitoring reports for the past 5 years, and FPL has reported no violations related to the discharge of metals in wastewater or stormwater discharges.

Additionally, as described in Section 3.7.4 of the FSEIS, since 2010, FPL has commissioned Ecology and Environment, Inc. to perform ongoing, semiannual ecological monitoring of the Turkey Point site and surrounding environment as a requirement of FDEP's Conditions of Certification in connection with the Turkey Point extended power uprate and the SFWMD's Fifth Supplemental Agreement. With respect to the aquatic environment, Ecology and Environment, Inc. monitors the CCS within the Turkey Point site, as well as three locations adjacent to the CCS within Biscayne Bay and Card Sound and one reference site in Barnes Sound that lies directly south of Card Sound. Ecological monitoring encompasses a total of 16 sampling points per study area and a total of 64 sampling points across all study areas. At each sampling location, researchers collect general physical parameters and quantitative and qualitative data about the submerged aquatic vegetation to characterize and observe changes in the ecological characteristics over time. FPL samples Biscayne Bay and Card Sound seagrasses biannually to monitor changes in cover and faunal composition over time and with distance from the CCS. Researchers qualitatively assess each sampling location for overall condition; presence or absence of seagrass, green algae (*Bataphora* spp.), and drift algae; amount of calcerous algae, sponges, and hard and soft corals; and substrate type and depth. Researchers also collect turtle grass (*Thalassia testudinum*) blades and process them in a laboratory for nutrient analysis.

FPL's reports have consistently demonstrated that the marsh and mangrove areas are representative of the hydrologically modified or nutrient-limited communities found along the coastal fringe of south Florida. Data indicate that the CCS does not have an ecological impact on the surrounding areas, and there is no clear evidence of CCS water in the surrounding marsh or mangrove areas from a groundwater pathway. Rather, ecological changes observed during the reporting period are more seasonally and meteorologically driven. Section 3.7.4 of the FSEIS describes the methods and results of these monitoring efforts in detail. To date, ecological monitoring has not detected evidence of any impacts from the CCS on the surrounding area, including Biscayne Bay and Card Sound (FPL 2022a).

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, the effects of nonradiological contaminants on aquatic organisms would be minor and would neither destabilize nor noticeably alter any important attribute of the aquatic environment during the SLR term. Accordingly, the NRC staff concludes that the effects of nonradiological contaminants on aquatic organisms due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.5 Exposure of Aquatic Organisms to Radionuclides

This issue concerns the potential impacts on aquatic organisms of exposure to radionuclides from routine radiological effluent releases. As explained in Section 2.9.1 of this EIS, radionuclides may be released from nuclear power plants into the environment through several pathways, including via gaseous and liquid emissions. Aquatic plants can absorb through their roots radionuclides that enter shallow groundwater or surface waters. Aquatic animals can be exposed externally to ionizing radiation from radionuclides in water, sediment, and other biota, and can be exposed internally through ingested food, water, and sediment and absorption through the integument and respiratory organs.

As discussed in Section 2.9.1 of this EIS, the DOE has produced a standard for a graded approach to evaluating radiation doses to aquatic and terrestrial biota (DOE 2019). The DOE standard provides methods, models, and guidance that can be used to characterize radiation doses to terrestrial and aquatic biota exposed to radioactive material (DOE 2019). For aquatic animals, the DOE guidance dose rate is 1 rad/d (0.1 Gy/d), which represents the level below which no adverse effects on resident populations are expected. The DOE also recommends that the screening-level concentrations of most radionuclides in aquatic environments be based on internal exposure as well as external exposure to contaminated sediments, rather than external exposure to contaminated water (DOE 2019).

Previously, in the early 1990s, the IAEA (1992) and the National Council on Radiation Protection and Measurements (NCRP 1991) had also concluded that a chronic dose rate of no greater than 1 rad/d (0.01 Gy/d) to the maximally exposed individual in a population of aquatic organisms would ensure protection of the population. The UNSCEAR concluded in 1996 and reaffirmed in 2008 that chronic dose rates of less than 0.4 mGy/hr (1.0 rad/day or 0.01 Gy/day) to the most highly exposed individuals would be unlikely to have significant effects on most aquatic communities (UNSCEAR 2010).

In the 2013 LR GEIS (NRC 2013a), the NRC estimated the total radiological dose that aquatic biota would be expected to receive during normal nuclear power plant operations using plant-specific radionuclide concentrations in water and sediments at 15 nuclear power plants using the Argonne National Laboratory's RESRAD-BIOTA dose evaluation model. The NRC found that total calculated dose rates for aquatic animals at all 15 plants were all less than 0.2 rad/d (0.002 Gy/d), which is less than the guideline value of 1 rad/d (0.01 Gy/d). As a result, the NRC anticipated in the 2013 LR GEIS that normal operations of these plants would not result in negative effects on aquatic biota. The 2013 LR GEIS concluded that the impact of radionuclides on aquatic biota from past operations would be SMALL for all nuclear power plants and would not be expected to change appreciably during the initial license renewal period.

The NRC staff did not specifically address the exposure of aquatic organisms to radionuclides as part of its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a) because that issue was not addressed in the 1996 LR GEIS, upon which the environmental review relied. The 2013 LR GEIS, however, did later address the issue generically for initial license renewal of all nuclear power plants and concluded that impacts would be SMALL and, accordingly, the FSEIS for the SLR of Turkey Point adopted that conclusion. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

As discussed in Section 2.9.1 of this EIS, the NRC requires nuclear power plants to maintain a REMP and to obtain data about measurable levels of radiation and radioactive material in the

environment. FPL established its REMP before Turkey Point began commercial operations, and it continues to monitor direct radiation and sample air, water, sediment, crustaceans, fish, and broadleaf vegetation annually for radionuclides. FPL reports the results of its monitoring to the NRC. Since Turkey Point began operating, REMP results have not indicated any significant radiological impacts on the surrounding environment attributable to Turkey Point operations.

As part of its environmental review, the NRC staff reviewed the past 5 years of REMP reports (FPL 2018i, 2019a, 2020b, 2021b, 2022e). During this period, the concentrations of radionuclides detected in air, shoreline, crustaceans, and fish samples were below the LLD. Surface water samples yielded detectable tritium in 8 to 16 percent of indicator sample locations each year at levels ranging from 93 to 128 pCi/L. Tritium concentrations were consistent with those detected in previous operational years and were all well below the reportable level of 30,000 pCi/L.

In summary, NRC regulations require nuclear power plants to monitor radiation in the environment and to report the results of such monitoring to the NRC through a REMP. The conduct of REMP monitoring ensures that levels of radiation are below regulatory limits and that any changes in radionuclide concentrations are detected and addressed. To date, FPL has not detected levels of radioactivity attributable to Turkey Point operations that would result in measurable radiological impacts on aquatic organisms. Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. For these reasons, radiological impacts would be minor and would neither destabilize nor noticeably alter any important attribute of the aquatic environment during the SLR term. Accordingly, the NRC staff concludes that the exposure of aquatic organisms to radionuclides due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.6 Effects of Dredging on Aquatic Organisms

This issue concerns the effects of dredging at nuclear power plants on aquatic resources.

Small-particle sediment, such as sand and silt, that enters water bodies through erosion can subsequently deposit and accumulate along shorelines and in shallow water areas. If sediment deposition affects cooling system function or reliability, a nuclear power plant may need to periodically dredge to improve intake flow and keep the area clear of sediment. Nuclear power plants where dredging may be necessary are typically located along fast-flowing waters that feature sandy or silty bottoms, such as large rivers or the ocean. In some instances, dredging may be performed to maintain barge slips for transport of materials and waste to and from the site. Dredging entails excavating a layer of sediment from the affected areas and transporting that sediment to onshore or offshore areas for disposal. The three main types of dredges are mechanical dredges, hydraulic dredges, and airlift dredges. The selection of dredge type generally is related to the sediment type, the size of the area to be dredged, and the aquatic resources present. At operating nuclear power plants, dredging is performed infrequently, if at all.

In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff did not consider dredging because FPL did not anticipate that dredging would be required during the Turkey Point initial license renewal period. The 2013 LR GEIS (NRC 2013a) analyzed the effects of dredging on aquatic organisms as a new issue and concluded that the effects of this issue would be SMALL during the initial license renewal term for all nuclear power plants. The FSEIS for the SLR of Turkey Point adopted the 2013 LR

GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

FPL anticipates no dredging during the SLR term (FPL 2022a). Therefore, there would be no impacts on aquatic resources. However, if FPL were to determine at a future date that dredging was necessary to, for instance, provide adequate clearance for barge deliveries, such dredging would require FPL to obtain permits from the USACE under CWA Section 404. BMPs and conditions associated with those permits would minimize impacts on the environment. The process of granting such permits would also require the USACE to conduct environmental reviews prior to FPL undertaking dredging.

The NRC staff expects that the effects of dredging on aquatic resources would be minor and would neither destabilize nor noticeably alter any important attribute of the aquatic environment during the SLR term. The NRC staff expects that FPL would continue to implement site environmental procedures and would obtain any necessary permits for dredging activities, if determined necessary. Implementation of such controls would further reduce or mitigate potential effects on the environment. Accordingly, the NRC staff concludes that the effects of dredging on aquatic resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.7 Effects on Aquatic Resources (Non-Cooling System Impacts)

This issue concerns the effects of nuclear power plant operations on aquatic resources that are unrelated to operation of the cooling system. Such activities include landscape and grounds maintenance, stormwater management, and ground-disturbing activities that could directly disturb aquatic habitat or cause runoff or sedimentation. These impacts are expected to be like past and ongoing impacts that aquatic resources are already experiencing at the nuclear power plant site.

The 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that the non-cooling system impacts on aquatic resources would be SMALL during the initial license renewal term. In the 1996 LR GEIS, the NRC evaluated the impacts of refurbishment on aquatic resources. In the 2013 LR GEIS, the NRC expanded this issue to include impacts of other site activities, unrelated to cooling system operation, that may affect aquatic resources. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

Within the Turkey Point site, aquatic features include hypersaline mudflats, remnant canals, channels, dwarf mangrove wetlands, and areas of open water. These features are part of, or located adjacent to, the CCS, mangrove swamp, and tidal flats located outside of the developed area of the site, and a barge basin adjacent to Biscayne Bay. As explained in Section 4.6.1.1 of the FSEIS, environmental impacts from landscape maintenance, ground-disturbing activities, and other operational activities would be minimized because FPL maintains environmental control procedures for any activities that result in the clearing of land, excavation, or other activity that would alter the physical environment or ecology of the site (FPL 2018b). FPL's procedures direct personnel to obtain appropriate local, State, or Federal permits (or some combination of the three) before beginning work; implement best practices to protect wetlands,

natural heritage areas, and sensitive ecosystems; and consult the appropriate agencies wherever federally or State-listed species may be affected. The Turkey Point Environmental Protection Plan contained in Appendix B of the subsequent renewed operating licenses requires FPL to prepare an environmental evaluation for any construction or operational activities that may significantly affect the environment (NRC 2019d). If such an evaluation indicates that an activity involves an unreviewed environmental question, the Turkey Point Environmental Protection Plan requires that FPL obtain approval from the NRC before performing the activity (NRC 2019d).

With respect to stormwater management, stormwater runoff from impervious surfaces can change the frequency or duration of inundation and soil infiltration within wetlands, mangroves, and neighboring terrestrial habitats. The effects of stormwater runoff may include erosion, altered hydrology, sedimentation, and other changes in plant community characteristics. Runoff may contain sediments, contaminants and oils from road or parking surfaces, or herbicides. At Turkey Point, stormwater collected in drainage channels and floor drains is discharged directly to the CCS. Turkey Point does not discharge stormwater directly into Biscayne Bay or any other surface waters other than the CCS. Use of the stormwater conveyance system, which collects stormwater, minimizes the amount of excess runoff that terrestrial habitats would receive and the associated effects. FDEP regulations require a stormwater permit and SWPPP for any construction activities or activities that would result in the clearing of land, excavation, or other action that would alter the physical environment or ecology of the site. FPL's SWPPP identifies potential sources of pollutants that could affect stormwater discharges and identifies BMPs that FPL uses to reduce pollutants in stormwater discharges to ensure compliance with applicable conditions of the permit (FPL 2023b). The BMPs include soil stabilization, such as seeding and structural controls (e.g., silt fences). FPL has also developed an SPCC plan that identifies and describes the procedures, materials, equipment, and facilities that are used to minimize the frequency and severity of oil spills (FPL 2018a). Collectively, these measures ensure that the effects on aquatic resources from pollutants carried by stormwater would be minimized during the SLR term.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, non-cooling system impacts on aquatic resources would be minor and would neither destabilize nor noticeably alter any important attribute of the environment during the SLR term. Accordingly, the NRC staff concludes that non-cooling system impacts on aquatic resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.8 Impacts of Transmission Line Right-of-Way Management on Aquatic Resources

This issue concerns the effects of transmission line ROW management on aquatic plants and animals. Transmission line management can directly disturb aquatic habitats if ROWs traverse aquatic features and heavy machinery is used in these areas. Heavy equipment can also compact soils, which can affect soil quality and reduce infiltration to shallow groundwater, resulting in runoff and erosion in nearby aquatic habitats. Chemical herbicides applied in ROWs can be transported to nearby aquatic habitats through precipitation and runoff. For small streams, trees may grow sufficiently between cutting cycles to provide shading and support microhabitats. Tree removal to maintain appropriate transmission line clearance could alter the suitability of habitats for fish and other aquatic organisms and locally increase water temperatures.

The 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that the impacts of transmission line ROW management on aquatic resources would be SMALL during the initial license renewal term. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

As explained in Section 2.9.4 of this EIS, which discusses the impacts of transmission line ROW management on terrestrial resources, the transmission lines within the scope of the Turkey Point SLR review are contained within the industrial use portion of the site. They do not cross any natural areas and vegetation management is not required. Therefore, maintenance of these lines has no discernible effect on ecological resources.

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, the effects of transmission line ROW management on aquatic resources would be minor and would neither destabilize nor noticeably alter any important attribute of plant or animal populations during the SLR term. Accordingly, the NRC staff concludes that the impacts of transmission line ROW management on aquatic resources due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.10.9 Losses from Predation, Parasitism, and Disease Among Organisms Exposed to Sublethal Stresses

This issue concerns the effects of nuclear power plant operation that can increase the susceptibility of aquatic organisms to predation, parasitism, and disease. Such sublethal effects can result from impingement, if an organism is subsequently returned to the source water body, as well as from exposure to thermal effluents. This issue does not apply to entrainment. Because entrainable organisms generally consist of fragile life stages, all entrained organisms are assumed to die (79 FR 48300) and would, therefore, not survive entrainment to subsequently experience sublethal effects.

The 1996 LR GEIS (NRC 1996) and the 2013 LR GEIS (NRC 2013a) concluded that the losses from predation, parasitism, and disease among organisms exposed to sublethal stresses would be SMALL during the initial license renewal term. In its environmental review of the FPL application for initial license renewal for Turkey Point (NRC 2002a), the NRC staff found no new and significant information concerning this issue and adopted the 1996 LR GEIS's conclusion of SMALL impacts for Turkey Point initial license renewal. Also, the FSEIS for the SLR of Turkey Point adopted the 2013 LR GEIS's conclusion of SMALL impacts for SLR. Below, the NRC staff analyzes this issue on a site-specific basis for the Turkey Point SLR term.

As established in Section 2.10 of this EIS, aquatic organisms inhabiting Biscayne Bay are not subject to impingement or the effects associated with exposure to thermal effluents because there are no surface water connections that allow flow between the waters of Biscayne Bay and the CCS. Therefore, the discussion below pertains to aquatic organisms in the CCS.

### *2.10.9.1 Sublethal Effects of Impingement*

The EPA's 2014 CWA Section 316(b) regulations establish best technology available standards for impingement mortality. Impingement mortality considers the survival rate of impinged organisms, rather than simply the total number of organisms impinged. Survival studies typically consider latent mortality associated with stunning, disorientation, or injury. Such effects can result from the injury itself or from increased susceptibility to predation, parasitism, or disease that results from the sublethal effects of impingement. As explained in Section 4.7.1.1 of the FSEIS (NRC 2019a), the Turkey Point intake system does not include a fish return system, and FPL has no plans to alter the design or function of the cooling system during the SLR term. Therefore, all impingements would result in mortality, and the issue of sublethal effects from impingement does not apply to Turkey Point SLR.

### *2.10.9.2 Sublethal Effects of Thermal Effluents*

Fish and shellfish that are exposed to the thermal effluent of a nuclear power plant may experience stunning, disorientation, or injury. These sublethal effects can subsequently affect an organism's susceptibility to predation, parasitism, or disease.

With respect to susceptibility to predation, laboratory studies of the secondary mortality of fish following exposure to heat or cold shock demonstrate the increased susceptibility of these fish to predation; however, field evidence of such effects is often limited to anecdotal information, such as observations of the increased feeding activity of seagulls and predatory fish near effluent outfalls (e.g., Cada et al. 1981). For example, Barkley and Perrin (1971) and Romberg et al. (1974) reported increased concentrations of predators feeding on forage fish attracted to thermal plumes. However, these studies did not quantify whether the observed behaviors resulted in population-level effects on prey species.

With respect to susceptibility to parasitism and disease, Langford (1983) found that the tendency for fish to congregate in heated effluent plumes, the increased physiological stress that higher water temperatures exert on fish, and the ability of some diseases and parasites to proliferate at higher temperatures were all factors that could contribute to increased rates of disease or parasitism in exposed fish. Some studies have suggested that crowding of fish within the thermal plume, rather than the thermal plume itself, may lead to an increased risk of exposure to infectious diseases (Coutant 1987).

The 1996 LR GEIS and the 2013 LR GEIS reported that neither scientific literature reviews nor consultations with agencies or utilities yielded clear evidence of nuclear power plant operation causing sublethal effects that result in noticeable increases in the susceptibility of exposed organisms to predation, parasitism, or disease. FPL reported no evidence of such effects, and FPL's continued implementation of its thermal efficiency plan would continue to improve CCS conditions and mitigate any potential effects (FPL 2022a).

Turkey Point operations during the SLR term would continue current operating conditions and environmental stressors rather than introduce wholly new impacts. Therefore, the impacts of current operations and SLR would be similar. For these reasons, losses from predation, parasitism, and disease among organisms exposed to sublethal stresses would be minor and would neither destabilize nor noticeably alter any important attribute of aquatic populations during the SLR term. Accordingly, the NRC staff concludes that the impacts of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.11 Socioeconomics

Turkey Point and the communities that support it can be described as a dynamic socioeconomic system. The communities supply the people, goods, and services required to operate the nuclear power plant. Power plant operations, in turn, supply wages and benefits for people and dollar expenditures for goods and services. The measure of a community's ability to support Turkey Point operations depends on the community's ability to respond to changing environmental, social, economic, and demographic conditions. The following sections address the site-specific environmental impacts of Turkey Point SLR on five environmental issues related to socioeconomics. The majority of Turkey Point permanent workers (85 percent) and contract workers (80 percent) reside in Miami-Dade County, and the most significant socioeconomic effects of plant operations are likely to occur in that county. The focus of the impact analysis and region of influence, therefore, is on the socioeconomic impacts of continued Turkey Point operations during the SLR term on Miami-Dade County.

### 2.11.1 Employment and Income, Recreation and Tourism

Nuclear power plants generate employment and income in the local economy. Therefore, continued operations and refurbishment associated with license renewal can affect employment, income, recreation, and tourism. Nuclear power plant operation provides employment and income and pays for goods and services. Wages, salaries, and expenditures generated by nuclear power plant operation create demand for goods and services in the local economy, while wage and salary spending by workers creates additional demand for services and housing. Additional employment and expenditures occur during refueling and maintenance outages and any refurbishment activities at nuclear power plants. Payments for these goods and services create additional employment and income opportunities in the community. Communities located near nuclear power plants in coastal regions experience summer, weekend, and retirement population increases due to the recreational and tourism activities that attract visitors. Some communities attract visitors interested in outdoor recreational activities. The aesthetic impacts of nuclear power plant operations and refurbishment activities could potentially affect tourism and recreational businesses.

FPL indicated that there are no planned SLR-related refurbishment activities, and that it has no plans to add additional employees to support plant operations during the Turkey Point SLR term (FPL 2022a). Therefore, SLR would not constitute new employment and new indirect jobs would not be created. FPL employs a permanent workforce of approximately 680 workers, and approximately 85 percent of this workforce resides in Miami-Dade County (FPL 2018a and FPL 2022a). In addition to permanent Turkey Point plant employees, FPL hires contract workers to support plant operations. FPL employs approximately 370 onsite contract workers and 80 percent of the contract workers reside in Miami-Dade County. Temporary employment is generated during routine outages. During refueling outages, onsite employment typically increases by an additional 1,200 workers for 25–30 days.

In 2021, the Miami-Dade County civilian labor force was 1,380,903 individuals, and 1,297,349 individuals were employed (USCB 2022c). Turkey Point's permanent workforce residing in Miami-Dade County represents a small fraction of Miami-Dade County's employed civilian labor force. In 2015, the average FPL nuclear power plant employee wage was $97,500 (NEI 2015a). Applying this average wage to the Turkey Point permanent workforce that resides in Miami-Dade County results in $56.34 million (97,500 × 680 × 0.85) going into the Miami-Dade County economy. In 2015, total wage earnings in Miami-Dade County were $54,557,797,108 (BLS 2015). In 2021, total wage earnings in Miami-Dade County were $65,149,278,279 (BLS 2022).

Annual wage earnings as a result of Turkey Point operations represent 0.1 percent of total wage earnings in Miami-Dade County. Any new employment and wages generated by regularly scheduled plant refueling and maintenance outages would be short-term and temporary.

The tourism industry is one of the largest sectors in the local economy in Miami-Dade County. Biscayne National Park and Everglades National Park attract approximately 7,500,000 and 1,000,000 visitors a year, respectively (NPS 2020 and NPF Undated). Biscayne National Park and Everglades National Park offer various recreational activities including sightseeing, snorkeling, boating, and fishing. In Section 2.3.1 of this EIS, the NRC staff considered the aesthetic impacts of Turkey Point continued operations during the SLR term and concluded that the impacts would be SMALL.

The effects of Turkey Point operations on employment, income, recreation, and tourism are ongoing and have become well established. As discussed above, the number of nuclear power plant operations workers is not expected to change during the SLR term. In addition, tourism and recreational activities in the vicinity of nuclear power plants are not expected to change as a result of SLR. The impacts from operations during the SLR term on employment and income in communities near nuclear power plants are not expected to noticeably change from those currently being experienced. As discussed above, Turkey Point permanent workforce and wages represent a small portion of Miami-Dade County's employed civilian workforce and total wage earnings. Aesthetic impacts from continued operations during the SLR term are SMALL and therefore are not expected to affect tourism and recreational businesses. Based on these considerations, the NRC staff concludes that the impacts due to continued nuclear power plant operations at Turkey Point during the SLR term on employment, income, recreation, and tourism would be SMALL.

### 2.11.2 Tax Revenues

Nuclear power plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT) payments, or tax payments related to energy production. Changes in the workforce and property taxes or PILOTs paid to local governments and public schools can directly affect socioeconomic conditions in the counties and communities near the nuclear power plant. Property tax assessments, settlements, and agreements, and State tax laws are continually changing the amount of taxes paid to tax jurisdictions by nuclear power plant owners, independent of license renewal or refurbishment activities. Tax revenues may be used by local, regional, and State governmental entities to fund education, public safety, local government services, and transportation. In smaller rural communities, nuclear power plant tax revenues can affect the level and quality of public services available to local residents. Even in semiurban regions, revenues from nuclear power plants provide support for public services at the local level. The primary impact of continued operation during the SLR term would be the continuation of the receipt of tax revenue to local governments and public school districts.

The State of Florida does not have a State-level property tax. Private property owners pay property taxes to the county and a local school district and may also pay taxes to regional taxing districts. In Florida, real estate property and tangible personal property are subject to property tax. Property values are set by the county property appraiser and are collected by the county tax collector. The tax rate (millage) is set by each taxing unit. County and school district governments may levy taxes up to 10 mills ($10.00 per thousand of assessed valuation) each. As discussed below, FPL pays property taxes (real and tangible personal property) for Turkey Point to Miami-Dade County, the Miami-Dade County Public School District, and several regional taxing districts (FPL 2018a and 2022a).

The Miami-Dade County budget comprises appropriations from various revenues. The total Miami-Dade County operating revenues for the years 2018 through 2021 are presented in Table 2-5. Property taxes are a significant source of Miami-Dade County funding. For instance, property tax revenues have ranged from 27 to 37 percent of the total Miami-Dade County revenues between 2018 and 2021 (MDC 2021). Miami-Dade County property taxes fund four separate taxing jurisdictions: Countywide, Unincorporated Municipality Service Area, the Fire Rescue District, and the Library System. Each of the four taxing jurisdictions is responsible for different types of services (MDC 2021). For instance, the Countywide jurisdiction provides public health and social services, transportation, regional parks, and county roads, the court systems, and the regional sheriff services and jails. Additionally, Miami-Dade County has a Countywide debt and a Fire Rescue District debt millage. The revenue raised from the debt service millage pays outstanding debt for voter-approved general or special obligation bonds. The amount of property tax received by a taxing jurisdiction is a result of the millage rate applied by each county taxing jurisdiction. For fiscal year 2020-2021, the total millage rate for Miami-Dade County (Countywide, Unincorporated Municipality Service Area, the Fire Rescue District, and the Library System, Countywide debt, and Fire Rescue District debt) was 9.7779. Miami-Dade County also imposes special district millage. These include the Children's Trust Authority, the Everglades Construction Project, the Okeechobee Basin, the SFWMD, and the Florida Inland Navigation District. For year 2021, the total millage rate for special district was 0.7502 (MDC 2020).

**Table 2-5 Miami-Dade County Total Operating Revenues, Miami-Dade County School Board Revenues, and Turkey Point Units 3 and 4 Total Property Tax Paid (2018–2021)**

| Property | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Miami-Dade County Total Operating Revenues (in billions of dollars) | 6.385 | 6.940 | 7.433 | 6.743 |
| Miami-Dade County School Board Revenues (in billions of dollars) | 3.868 | 3.948 | 4.120 | 4.458 |
| Turkey Point Units 3 and 4 Total Property Tax Paid (in billions of dollars) | 0.034 | 0.045 | 0.035 | 0.036 |
| Percent Payment Assigned to Miami County | 54.4 | 56.6 | 55.2 | 55.4 |
| Percent Payment Assigned to School District | 39.2 | 39 | 40.4 | 40.4 |
| Percent Payment Assigned to Special District | 6.4 | 4.4 | 4.4 | 4.2 |

Sources: MDCPS 2021; MDC 2021; FPL 2022a.

The Miami-Dade County Public School District is a taxing entity separate from Miami-Dade County. The Florida Education Finance Program is the primary mechanism for funding the operating costs of Florida school districts (FDE 2022). The Florida Education Finance Program allocates funds to the Miami-Dade County Public School District based on student enrollment (FDE 2022). Funding for school districts comes from State, local, and Federal sources. Local funding is obtained primarily from property taxes levied by Florida's counties, each of which constitutes a school district. Property taxes on properties located within the school district are levied after the millage rate is certified. Table 2-5 presents the Miami-Dade County School Board revenues for years 2018 through 2021. Property tax revenues provided approximately 52 to 56 percent of the total Miami-Dade County School Board revenues for years 2018 through 2021 (MDCPS 2021). For year 2021, Miami-Dade County School Board millage was 7.129 (MDC 2020).

Turkey Point property tax payments for 2018 through 2021 are presented in Table 2-5. In 2019, Miami-Dade County over-assessed the taxable values for Turkey Point, resulting in an overpayment of property taxes to Miami-Dade County by FPL (FPL 2022a). Due to the timing of the discovery and the potential related impacts on municipalities in Miami-Dade County, the County and FPL agreed to address the overpayment in the year 2020 (FPL 2023a). FPL worked with Miami-Dade County to adjust the 2020 payment accordingly (FPL 2023a). Turkey Point property tax payments to Miami-Dade County and the Miami-Dade County Public School District have represented less than 1 percent of the Miami-Dade County revenue and of the Miami-Dade County Public School District revenues. FPL does not expect there to be a noticeable or significant change in future property tax payments during the SLR term (FPL 2018a and FPL 2022a). Given that FPL does not plan to conduct refurbishment activities during the SLR term, changes in the assessed value of Turkey Point from these activities are not anticipated. Therefore, tax payments during the SLR term would be similar to those already being paid. Based on these considerations, the NRC staff concludes that the impacts on tax revenue resulting from continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.11.3 Community Services and Education

Nuclear power plant operations and refurbishment activities as a result of workforce changes can affect the availability and quality of community (i.e., public safety and public utilities) and educational services. An increase in operations and refurbishment activity and related populations can increase the demand and cause disruption of community services and education. The impact on community and educational services will depend on the projected number of in-migrating workers and their families during the renewal term and the ability to respond to the level of demand for services. Tax payments from nuclear power plants can support a range of community services and have a beneficial impact on the quality and availability of these services to local residents.

FPL indicated that there are no planned SLR-related refurbishment activities, and that FPL has no plans to add additional employees to support plant operations during the SLR term (FPL 2022a). Therefore, continued operations of Turkey Point will not result in an increase in or additional demand for services as a result of an influx of permanent workers during the SLR term. Any potential increase in demand for community and educational services would be from the increase in number of workers at FPL during regularly scheduled plant refueling and maintenance outages. However, impacts on community and education services during SLR would be the same that have occurred during past operations of Turkey Point. The discussion that follows presents current community and educational services in Miami-Dade County.

The Miami-Dade Police Department is the largest police department in Miami and the eighth largest department. In 2021, 3,052 sworn officers and 1,499 civilians were employed by the Miami-Dade Police Department (MDPD 2022). The Miami-Dade Fire Rescue (MDFR) is one of the top 10 largest fire rescue departments in the United States. MDFR has 71 fire rescue stations and 2,220 active firefighters (MDFR 2022).

The Miami-Dade Water and Sewer Department (MDWSD) is the main public water supplier in Miami-Dade County. Miami-Dade County relies on groundwater withdrawn from the Biscayne Aquifer. Water is provided by MDWSD through four regional water treatment plants: Hialeah and John E. Preston Water Treatment Plant, the Hialeah Reverse Osmosis Water Treatment Plant, the Alexander Orr, Jr. Water Treatment Plant, and the South Dade Water Supply System (which comprises five smaller water treatment plants) (MDC 2014). The Newton Water

Treatment Plant (part of the South Dade Water Supply System) serves Turkey Point. In addition to the MDWSD, four water suppliers within Miami-Dade County provide water to parts of unincorporated Miami-Dade County and within their municipal boundaries: the City of North Miami, the City of North Miami Beach, Florida City, and the City of Homestead. The MDWSD total wellfield supply capacity is 634.01 MGD and the installed treatment facility capacity is 497.19 MGD (MDC 2014). According to the Miami-Dade Water Supply Facilities Work Plan (MDC 2014), when taking into consideration water conservation, by 2033, annual average daily water demand in the MDWSD service area is projected to be 352 MGD (MDC 2014). Based on this information, the MDWSD waste supply and treatment systems have sufficient installed capacity to produce potable water through 2033.

MDWSD operates three regional wastewater treatment facilities and serves more than 2.5 million customers: Central District Wastewater Treatment Plant, North District Wastewater Treatment Plan, and South District Wastewater Treatment Plant. Treated wastewater at the North District Wastewater Treatment Plant and the Central District Wastewater Treatment Plant is discharged into the Atlantic Ocean. Treated wastewater at the South District Wastewater Treatment Plant is discharged though deep injection wells into the Lower Floridan Aquifer. Ocean Outfall legislation requires utilities in Southeast Florida using ocean outfalls for disposal of treated wastewater to eliminate the normal use of the ocean outfalls by 2025 and reuse 60 percent of the wastewater flows by 2025 (MDWSD 2019). In response to this legislation, the MDWSD plans to add deep injection wells at the Central and North District Wastewater Treatment Plants to eliminate the use of ocean outfalls. The MDWSD has experienced decreases in wastewater generation, and average flows have remained consistently flat over the last 20 years. The MDWSD evaluated 2035 wastewater flow projections and found that wastewater volumes are projected to be 366 MGD by 2035, and that the existing annual average day flow capacity at the waste treatment plants will be sufficient through 2035 (MDWSD 2019)

The Miami-Dade County Public School District comprises 400 public schools and approximately 350,000 students (GFLA 2022). The Miami-Dade County Public School District is the third largest school district in the United States (MDCPS 2022). The 2020-2021 Miami-Dade County Public School District total revenue was $4,458 million (MDCPS 2021). An amendment to the Florida Constitution approved in 2002 set limits on the number of students in core classes (e.g., math, science, etc.) in public schools. These limits, and the average class size for traditional schools in the Miami-Dade County Public School District, are shown in Table 2-6. Mandated class sizes are met by Miami-Dade County public schools. School enrollment in the Miami-Dade County Public School District has been in a general decline. According to Miami-Dade County Public School District statistics, when comparing the number of students between the 2001-2002 and 2021-2022 school years, enrollment has decreased by more than 45,000 students (MDCPS 2009, 2022; WLRN 2022)

**Table 2-6 Miami-Dade County Public School District Class Limits and Average Class Size**

| Grade Levels | Mandated Class Size | Average Class Size |
|---|---|---|
| Pre-K–3 | 18 | 12.25 |
| 4–8 | 22 | NA |
| 9–12 | 25 | 12.00 |

Source: FDE 2016; NA = Not Available

Given that substantial workforce changes at Turkey Point Units 3 and 4 are not expected to occur during the SLR term, the plant's demand and effects on community services and education in the vicinity of the plant are not expected to change from what is currently being experienced. As discussed above, existing services in Miami-Dade County are adequate and the impacts on community services and education resulting from Turkey Point operations during the SLR term are not expected to change. Therefore, the NRC staff concludes that community services and education impacts due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.11.4 Population and Housing

Population and housing demand and availability can be affected by changes in the numbers of workers at a nuclear power plant related to continued operations and refurbishment activities. Population growth from employment at a nuclear power plant is one of the main drivers of socioeconomic impacts. Population growth can occur as a result of an increase in the number of permanent onsite employees during the SLR term, as well as increases in the number of workers at a nuclear power plant during regularly scheduled plant refueling and maintenance outages and during refurbishment activities. Plant refueling and maintenance outages and refurbishment activities, however, are of temporary and short duration and therefore create a short-term increase in employment. In the vicinity of nuclear power plants, the number of housing units and the type and quality of available housing varies. Long-term housing demand can be affected by changes in the number of permanent onsite employees. Short-term increase in the demand for temporary (rental) housing occurs during periodic outages or refurbishment activities, when refueling and maintenance workers require rental accommodations.

Table 2-7 shows population and percent growth and projections from 1990 to 2070 in Miami-Dade County. Over the last several decades, Miami-Dade County has experienced increasing population. Based on population projections, the population in Miami-Dade County is expected to continue to increase, but at a slower rate. FPL employs a permanent workforce of approximately 680 workers (FPL 2018a and FPL 2022a). Approximately 85 percent of the workforce resides in Miami-Dade County. The remaining workers are spread among 12 counties in Florida and Georgia, with numbers ranging from 1 worker to 49 workers per county (FPL 2018a and FPL 2022a). FPL also employs approximately 370 onsite contract workers; 80 percent of the contract workers reside in Miami-Dade County (FPL 2018a and FPL 2022a). During refueling outages, onsite employment typically increases by an additional 1,200 workers for 25–35 days.

**Table 2-7 Population and Percent Growth in Miami-Dade County, 1990–2070**

| Year | Miami-Dade County Population | Percent Change Since Previous Entry |
|---|---|---|
| 1990 | 1,937,094 | - |
| 2000 | 2,253,362 | 16.3 |
| 2010 | 2,496,435 | 10.8 |
| 2020 | 2,701,767 | 8.2 |
| 2030 | 3,167,900 | 17.3 |
| 2040 | 3,399,200 | 7.3 |
| 2050 | 3,714,000 | 9.3 |
| 2060 | 4,001,700 | 7.7 |
| 2070 | 4,284,300 | 7.1 |

Sources: Decennial population data for 1970–2020 (USCB 1996, 2000, 2012, 2020); Projected population for 2030–2070 (FDOT 2020).

FPL has no plans to add additional employees to support plant operations during the SLR term and there are no planned SLR-related refurbishment activities (FPL 2018a and FPL 2022a). Therefore, SLR would not involve new employment. Any population increase would be from the increased number of workers at FPL during regularly scheduled plant refueling and maintenance outages during the SLR term. Outage workers represent less that 1 percent of the 2020 and 2030–2070 projected population in Miami-Dade County. Furthermore, plant refueling and maintenance outages and refurbishment activities are of temporary and short duration and therefore would create a short-term increase in employment and population changes.

Because FPL has no plans to add additional employees to support plant operations during the SLR term and because there are no planned SLR-related refurbishment activities, increases in housing demand would only occur as a result of the short-term (25–35 days) increase in the number of workers (approximately 1,200) during regularly scheduled plant refueling and maintenance outages. Table 2-8 lists the total number of occupied and vacant housing units in Miami-Dade County. Based on the United States Census Bureau (USCB) 2021 American Community Survey 1-year estimates (USCB 2022a, 2022b), there were 1,084,304 housing units in Miami-Dade County, of which 120,827 were vacant, and 56,916 housing units are vacant for seasonal, recreational, or occasional use. Therefore, Miami-Dade County has available vacant housing units to support the outage workforce.

**Table 2-8 Housing in Miami-Dade County, 2021 Estimates**

| Property | Miami-Dade County |
|---|---|
| Total Housing Units | 1,084,304 |
| Occupied Housing Units | 963,477 |
| Total Vacant Housing Units | 120,827 |
| Vacant Housing Units for Seasonal, Recreational, or Occasional Use | 56,916 |

Sources: USCB 2022a and 2022b

The 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. The NRC staff determined that little or no population growth or increased demand for housing would occur during the SLR term. Therefore, the NRC staff concludes that population and housing impacts due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.11.5 Transportation

Continued operations and refurbishment associated with the SLR term can affect traffic volumes and local transportation systems. Local and regional transportation networks in the vicinity of nuclear power plants may vary considerably depending on the regional population density, location, and size of local communities; nature of economic development patterns; location of the region relative to interregional transportation corridors; and land surface features, such as mountains, rivers, and lakes. 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 nuclear power plant.

The transportation network surrounding Turkey Point comprises U.S. highways, Interstate highways, local streets, and waterways. There are no ports or rail systems located within 6 mi (9.6 km) of Turkey Point. The nearest rail line, operated by CSX Corporation, is located

approximately 10 mi (16 km) west of Turkey Point in Homestead, Florida; and the Port of Miami is located approximately 23 mi (37 km) north of the plant. NUREG-2176, "Environmental Impact Statement for Combined Licenses (COLs) for Turkey Point Nuclear Plant Units 6 and 7," dated October 2016, describes this transportation network in Section 2.5.2.3 (NRC 2016); the NRC staff incorporates pages 2-175 through 2-178 of NUREG–2176 into this EIS by reference.

Access to Turkey Point is via East Palm Drive (SW 344 St.). East Palm Drive is a four-lane road that turns into a two-lane road at its intersection with Tallahassee Road (SW 137th Avenue) as it leads to the Turkey Point site. East Palm Drive intersects with US-1 approximately 8 mi (12.8 km) from Turkey Point. East Palm Drive provides access to the Homestead-Miami Speedway and Homestead Bayfront Park. The reported 2021 average annual daily two-way traffic volume for the monitoring site closest to Turkey Point on East Palm Drive was 8,300 vehicles; annual daily traffic has decreased along East Palm Drive since 2017 (FDOT 2022)

In Miami-Dade County all State and County roads need to operate at or above a level of service (LOS) C outside of the Urban Development Boundary (MDC 2012). The Transportation Research Board LOS designations define the flow of traffic on a designated highway. LOS designations can range from traffic freely flowing (LOS A) to a point where traffic flow exceeds the design capacity of the highway resulting in severe congestion (LOS F). In 2009, FPL commissioned a traffic study in connection with peak construction activities associated with the proposed Turkey Point Units 6 and 7 (Traf Tech 2009). The traffic study assessed the available capacity from three traffic stations in the vicinity of the Turkey Point site (see Table 2-9). In Table 2-9, peak hour capacity (i.e., the maximum number of cars that can be supported on a road per hour), minus the peak number of trips (i.e., the maximum existing traffic volume), produces an estimate of the available peak hour capacity (i.e., how many more vehicles can be accommodated on the road per hour). As indicated in Table 2-9, the traffic stations in the vicinity of the Turkey Point site have sufficient peak hour capacity to accommodate additional traffic and LOS designations operate at or above Miami-Dade County's adopted LOS C, which provides an acceptable level of service.

**Table 2-9 Peak Hour Traffic, Reserve Capacity, and Level of Service at Roads in the Vicinity of the Turkey Point Site**

| Station No. | Location | Peak Hour Capacity[(a)(b)] | Peak Hour Trips[(a)(c)] | Available Peak Hour Capacity[(a)(d)] | Level of Service |
|---|---|---|---|---|---|
| 9556 | Palm Drive/SW 344 west of 137th Ave/Tallahassee Road | 3,030 | 231 | 2,799 | B |
| 9952 | SW 328th St./North Canal Dr. west of SW 137th Ave/ Tallahassee Road | 2,600 | 254 | 2,346 | A |
| 9944 | SW 312th St./Campbell Drive east of Homestead Extension of Florida's Turnpike | 3,350 | 2,061 | 1,289 | C |

(a) Passenger car unit.
(b) Maximum level of service capacity
(c) Existing traffic volumes
(d) Peak hour capacity minus peak hour trips
Source: Traf Tech 2009.

FPL indicated in ER Supplement 2 that there are no planned SLR-related refurbishment activities, and that FPL has no plans to add additional employees to support plant operations during the SLR term (FPL 2022a). Increases in the number of workers would occur during

regularly scheduled plant refueling and maintenance outages. During refueling outages, onsite employment typically increases by an additional 1,200 workers and staff is split into two work shifts (FPL 2023a). However, because of the short duration of the outages (25–35 days), outages result in short-term increases in traffic volumes and, as noted in Table 2-9, roads in the vicinity of Turkey Point have sufficient peak hour capacity to accommodate additional traffic. Consistent with this information, the existing traffic from Turkey Point's workforce has not resulted in an exceedance of the capacity of roads, and roads have operated adequately. Transportation impacts are ongoing and have become well established in the vicinity of Turkey Point. Given that the size of the workforce is not expected to increase during the SLR term and given the capacity availability of roads in the vicinity of Turkey Point, traffic on the roads surrounding Turkey Point would not noticeably increase relative to the current traffic volumes. No transportation impacts during the SLR term would occur beyond those already being experienced. Therefore, the NRC staff concludes that the impacts on transportation due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.12 Human Health

Human health at all nuclear power plants has been well established during the current license term. Based on past environmental monitoring data and trends (discussed in detail in the 1996 LR GEIS and the 2013 LR GEIS), the NRC staff concludes that no significant human health impacts are anticipated during the SLR term that would be different from those occurring during the current license term. Certain operational changes (such as extended power uprates) that could potentially affect human health would be evaluated by the NRC in a separate safety and environmental review if such operational changes were to be requested by a licensee in the future. The following sections address the site-specific environmental impacts of Turkey Point SLR on five environmental issues related to human health.

### 2.12.1 Radiation Exposures to the Public

Nuclear power plants, under controlled conditions, release small amounts of radioactive materials to the environment during normal operation. NRC regulations in 10 CFR Part 20 identify maximum allowable concentrations of radionuclides that can be released from a nuclear power plant, such as Turkey Point, into the air and water above background at the boundary of unrestricted areas, to control radiation exposures of the public and releases of radioactivity. These concentrations are derived based on an annual total effective dose equivalent (TEDE) of 0.1 rem to individual members of the public. In addition, pursuant to 10 CFR 50.36a, "Technical specifications on effluents from nuclear power reactors," nuclear power plants have special license requirements, called technical specifications, for radioactive gaseous and liquid releases from the plant to minimize the radiological impacts associated with plant operations to levels that are as low as is reasonably achievable (ALARA).

Radioactive waste management systems are incorporated into the design of each plant. They are designed to remove most of the fission product radioactivity that leaks from the fuel, as well as most of the activation- and corrosion-product radioactivity produced by neutrons in the vicinity of the reactor core. The amounts of radioactivity released through vents and discharge points to areas outside the plant boundary are recorded and published annually in the radioactive effluent release reports. These environmental monitoring programs are in place at all plants. Because there is no reason to expect effluents to increase at Turkey Point during the SLR term, doses from continued operation during the SLR term are expected to be well within regulatory limits established in 10 CFR Part 20 and 40 CFR Part 190, "Environmental Radiation

Protection Standards for Nuclear Power Operations." No mitigation measures beyond those already implemented under the licenses would be warranted, because current mitigation practices have kept public radiation doses well below regulatory standards and are expected to continue to do so.

The NRC staff reviewed Turkey Point effluent release reports for the years 2018 through 2022 (FPL 2019b, 2020c, 2021a, 2022c, 2023c) and determined that the recorded annual public dose is a fraction of the regulatory limits and was in accordance with radiation protection standards identified in 10 CFR Part 50 (Appendix I), 10 CFR Part 20, and 40 CFR Part 190. This 5-year review period provided a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance that can affect the generation and release of radioactive effluents into the environment. The NRC staff looked for indications of adverse trends (e.g., increasing radioactivity levels) over the period of 2018 through 2022. Based on its review of this information, the NRC staff found no apparent increasing trend in concentration or pattern indicating either a new inadvertent release or persistently high tritium concentrations that might indicate an ongoing inadvertent release from Turkey Point. The groundwater monitoring program at Turkey Point is robust, and any future leaks that might occur during the SLR term should be readily detected. All spills are well monitored, characterized, and actively remediated. Taken together, the data show that there have been no significant radiological impacts on the environment from operations at Turkey Point.

Radiation doses to the public from continued operation are expected to continue at current levels and to remain below regulatory limits during the SLR term. The NRC staff identified no information for Turkey Point that would result in different impacts than those of current operations. The NRC staff concludes that the health impacts from public radiation exposure due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL based on public doses being maintained within regulatory limits.

### 2.12.2 Radiation Exposures to Plant Workers

Nuclear power plant workers conducting activities involving radioactively contaminated systems or working in radiation areas can be exposed to radiation. Individual occupational doses are measured by nuclear power plant licensees as required by the NRC radiation protection standard at 10 CFR Part 20. Most of the occupational radiation dose to nuclear power plant workers results from external radiation exposure rather than from internal exposure from inhaled or ingested radioactive materials. Workers also receive radiation exposure during the storage and handling of radioactive waste. Occupational doses from refurbishment activities (if any are conducted) and occupational doses from continued operations during the SLR term are expected to be similar to the doses experienced during current operations and to be bounded by the analysis conducted in the 1996 LR GEIS. The occupational doses are estimated to be much less than the doses allowed by the regulatory dose limits.

Under 10 CFR 20.2206, "Reports of individual monitoring," the NRC requires nuclear power plant licensees to submit an annual report of the results of individual monitoring carried out by the licensee for each individual for whom monitoring was required by 10 CFR 20.1502, "Conditions requiring individual monitoring of external and internal occupational dose," during that year. The NRC staff reviewed the Turkey Point occupational dose reports and summary reports through 2020 (NRC 2022f) and identified no information for Turkey Point that would result in different impacts than those of current operations. The NRC staff concludes that the health impacts from occupational radiation exposure due to continued nuclear power plant

operations at Turkey Point during the SLR term would be SMALL based on individual worker doses being maintained within 10 CFR Part 20 limits. No mitigation measures beyond those implemented during the current license term would be warranted, because the ALARA process would continue to be effective in reducing radiation doses.

### 2.12.3 Human Health Impact from Chemicals

State and Federal environmental agencies regulate the use, storage, and discharge of chemicals, biocides, and sanitary wastes. Such environmental agencies also regulate how facilities like Turkey Point manage minor chemical spills. Chemical and hazardous wastes can potentially affect workers, members of the public, and the environment.

FPL currently controls the use, storage, and discharge of chemicals, biocides, and sanitary wastes at Turkey Point in accordance with its chemical control procedures, waste management procedures, and Turkey Point site-specific chemical spill prevention plans. FPL monitors and controls discharges of chemicals, biocides, and sanitary wastes through Turkey Point's NPDES permit process. These plant procedures, plans, and processes are designed to prevent and minimize the potential for a chemical or hazardous waste release and, in the event of such a release, minimize the impact on workers, members of the public, and the environment. The NRC staff concludes that the health impacts from chemicals, biocides, and sanitary wastes due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL based on these procedures, plans, and processes.

### 2.12.4 Microbiological Hazards to Plant Workers

No change in existing microbiological hazards to plant workers is expected due to SLR, for the same reasons discussed in detail in the 2013 LR GEIS (NRC 2013a) for initial license renewal. The NRC staff considers it unlikely that any nuclear power plants that have not already experienced occupational microbiological hazards would do so during the SLR term or that hazards would increase during the SLR term. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. FPL is expected to continue to employ proven industrial hygiene principles so that adverse occupational health effects associated with microorganisms due to continued nuclear power plant operations at Turkey Point during the SLR term would be of SMALL significance, and no mitigation measures beyond those implemented during the current license term would be warranted.

### 2.12.5 Physical Occupational Hazards

Nuclear power plants are industrial facilities that have many of the typical occupational hazards found at any other electric power generation utility. Nuclear power plant workers may perform electrical work, electric powerline maintenance, repair work, and maintenance activities and may be exposed to potentially hazardous physical conditions (e.g., falls, excessive heat, cold, noise, electric shock, and pressure).

The Occupational Safety and Health Administration (OSHA) is responsible for developing and enforcing workplace safety regulations. With respect to nuclear power plants, plant conditions that result in an occupational risk, but do not affect the safety of licensed radioactive materials, are under the statutory authority of OSHA rather than the NRC as set forth in a Memorandum of Understanding (NRC 2013b) between the NRC and OSHA. Occupational hazards are reduced when workers adhere to safety standards and use appropriate protective equipment; however,

fatalities and injuries caused by accidents may still occur. FPL maintains an occupational safety program at Turkey Point for its workers in accordance with OSHA regulations. The NRC staff has identified no information or situations that would result in different impacts for this issue for this SLR term at Turkey Point. The NRC staff expects that FPL will continue to employ an occupational safety program so that physical occupational hazards due to continued nuclear power plant operations at Turkey Point during the SLR term are minimized and would be of SMALL significance.

## 2.13 Postulated Accidents

The following section and Appendix D address the site-specific environmental impacts of Turkey Point SLR on environmental issues related to postulated accidents.

### 2.13.1 Design Basis Accidents

Design basis accidents are postulated accidents that a nuclear power plant must be designed and built to withstand without loss of the systems, structures, and components necessary to ensure public health and safety. Planning for design basis accidents ensures that the plant can withstand normal transients (e.g., rapid changes in the reactor coolant system temperature or pressure, or rapid changes in reactor power), as well as a broad spectrum of postulated accidents without causing undue hazard to the health and safety of the public. Many of these design basis accidents may occur but are unlikely to occur during the life of the plant; nevertheless, carefully evaluating each design basis accident is crucial to establishing the design basis of the plant's preventive and mitigative safety systems. 10 CFR Part 50 and 10 CFR Part 100, "Reactor Site Criteria," describe the NRC's acceptance criteria for design basis accidents.

Before the NRC will issue an operating license for a nuclear power plant, the applicant must demonstrate the ability of the plant to withstand all design basis accidents. The applicant and the NRC staff evaluate the environmental impacts of design basis accidents for the hypothetical maximally exposed individual (MEI). The results of these design basis accident evaluations are found in the plant's original licensing documents, such as the applicant's final safety analysis report, the NRC staff's safety evaluation report, and the NRC staff's final environmental statement. Once the NRC issues the operating license for the plant, the licensee is required to maintain the design and performance criteria that were found to be acceptable (which includes withstanding design basis accidents), referred to, in part, as the plant's current licensing basis (CLB), throughout the operating life of the plant, including any license renewal terms.

Pursuant to 10 CFR 54.29, "Standards for issuance of a renewed license," license renewal applicants are required to manage the effects of aging and perform any required time-limited aging analyses (as further described in the regulation), such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the plant's CLB and that any changes made to the plant's CLB in order to comply with 10 CFR 54.29 are in accordance with the Atomic Energy Act of 1954, as amended (AEA; 42 U.S.C. 2011 et seq.) and the Commission's regulations. Because of the requirement that the existing design basis and aging management programs be in effect for the renewal term, the environmental impacts of design basis accidents as calculated for the original operating license application should not differ significantly from the environmental impacts of design basis accidents at any other time during plant operations, including during the SLR term. Accordingly, the NRC staff considers the design of the plant, relative to design basis accidents, to remain acceptable during the SLR term.

Under the NRC's license renewal rules in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plans," SLR applicants must take adequate steps to account for aging during the SLR term either by updating time-limited aging analyses or implementing aging management plans. Based on these required activities, the NRC staff expects that operation during the SLR term would continue to provide a level of safety equivalent to that provided during the current license term. Furthermore, as provided in the statement of considerations for 10 CFR Part 54 (60 FR 22491), the Commission believes that considerable experience has demonstrated that its regulatory process provides adequate assurance that degradation due to the aging of structures, systems, and components that perform active safety functions will be appropriately managed to ensure their continued functionality during the period of extended operation. Furthermore, although the definition of CLB in 10 CFR Part 54 is broad and encompasses various aspects of the NRC regulatory process (e.g., operation and design requirements), the Commission concluded that a specific focus on functionality is appropriate for performing license renewal reviews. Reasonable assurance that the functionality of important structures, systems, and components will be maintained throughout the renewal term, combined with the rule's stipulation that all aspects of a plant's CLB (e.g., technical specifications) and the NRC's regulatory process carry forward into the renewal period, support a conclusion that the CLB (which represents an acceptable level of safety) will be maintained. Functional capability is the principal emphasis for much of the CLB and is the focus of other regulatory requirements to ensure that aging issues are appropriately managed during the license renewal term, including any subsequent license renewal term.

The early identification and resolution of design basis accidents as part of the issuance of an operating license make them a part of a plant's CLB. The NRC requires a licensee to maintain its plant's CLB under the current operating license, as well as during any license renewal term including the SLR term. Therefore, under the provisions of 10 CFR 54.30, "Matters not subject to a renewal review," design basis accidents are not subject to review as part of the NRC's license renewal process.

Consistent with the above discussion and as stated in Section 5.3.2 of the 1996 LR GEIS, the environmental impact of design basis accidents is assessed in the NRC staff's plant-specific environmental review associated with the issuance of the operating license for a plant. Because the licensee is required to maintain the plant within acceptable design and performance criteria after operating license issuance, including during any license renewal term, these environmental impacts are not expected to change significantly.

In the 2013 LR GEIS, the NRC reexamined the information from the 1996 LR GEIS regarding design basis accidents and concluded that this information is still valid. The NRC found that the environmental impacts of design basis accidents are of SMALL significance for the license renewal of all nuclear power 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. The NRC also determined that the environmental impacts during a license renewal term should not differ significantly from the impacts calculated for the design basis accident assessments conducted during the initial plant licensing process. Impacts from design basis accidents would not be affected by changes in the plant's environment because such impacts (1) are based on calculated radioactive releases that are not expected to change, (2) are evaluated for the hypothetical MEI, and (3) have been previously determined acceptable (NRC 1996, 2013a).

An example of the NRC's previous review of Turkey Point's design basis accidents is the June 23, 2011, "Issuance of Amendments Regarding Alternative Source Term" (NRC 2011), in which the NRC staff determined that the radiological consequences estimated by the licensee for various design basis accidents at Turkey Point will comply with the requirements of 10 CFR 50.67, "Accident source term," and the guidelines of RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (NRC 2000), and are therefore acceptable. Another example is the NRC's review of updated external hazards information for all operating power reactors (as ordered by the Commission after the Fukushima Dai-Ichi accident). On March 24, 2020, the NRC completed its review of Fukushima-related information relevant to Turkey Point and concluded that no further regulatory actions were needed to ensure adequate protection or compliance with regulatory requirements, thereby reconfirming the acceptability of Turkey Point's design basis (NRC 2020a).

In its ER included in the Turkey Point SLR application, FPL did not identify any new and significant information related to the environmental impacts of design basis accidents at Turkey Point (FPL 2018f). The NRC staff also did not identify any new and significant information related to the environmental impacts of design basis accidents at Turkey Point during its independent review of FPL's ER, through the scoping process, or in its evaluation of other available information. Therefore, in the FSEIS, the NRC staff concluded that the environmental impacts of design basis accidents at Turkey Point during the SLR term would be SMALL.

Based upon its review of FPL's SLR application, including ER Supplement 2, the NRC staff has determined that the environmental impacts of design basis accidents at Turkey Point during the SLR term are of SMALL significance because the plant was designed to successfully withstand these accidents. Due to the requirements for FPL to maintain the Turkey Point CLB (which the NRC has previously determined to be acceptable) and implement aging management programs, the environmental impacts of design basis accidents during the SLR term are not expected to differ significantly from those calculated and found to be acceptable as part of the initial plant licensing process. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the environmental impacts of design basis accidents at Turkey Point during the SLR term would be SMALL based on previous determinations of the acceptability of the CLB and the regulatory requirement for the continuation of the CLB during any license renewal term including the SLR term.

### 2.13.2 Severe Accidents

As discussed in Section 2.13.1 above, U.S. nuclear power plants must be designed and built to withstand design basis accidents without loss of the systems, structures, and components necessary to ensure public health and safety. As also discussed above, these accidents include normal transients as well as a broad spectrum of postulated accidents. In contrast, "severe accidents" are accidents that could have severe consequences but, due to their extremely low likelihood of occurrence, are not required to be included within the range of design basis accidents that a plant must be able to withstand. This principle applies to initial reactor licensing, as well as initial and subsequent license renewal, because the NRC's regulations in 10 CFR 54.29 require license renewal applicants to manage the effects of aging and perform any required time-limited aging analyses, such that there is reasonable assurance (1) that the activities authorized by the renewed license will continue to be conducted in accordance with the plant's CLB and (2) that any changes made to the plant's CLB in order to comply with 10 CFR 54.29 are in accordance with the AEA and the Commission's regulations. Thus, the environmental impacts of design basis accidents as calculated for the original operating license

application, should not differ significantly from the environmental impacts of design basis accidents at any other time during plant operations, including during the SLR term.

With respect to severe accidents (i.e., postulated accidents that are more severe than design basis accidents because severe accidents can result in substantial damage to the reactor core, whether or not there are serious offsite consequences), the Commission concluded that the probability-weighted consequences of severe accidents are SMALL for all plants (NRC 1996). Nonetheless, the Commission has required that an analysis of severe accident mitigation alternatives (SAMAs) be conducted for license renewal if such an analysis has not been conducted previously (NRC 1996).

As discussed in the Turkey Point FSEIS (NRC 2019a) and Appendix D in this EIS, FPL conducted a site-specific SAMA analysis in its initial license renewal application for Turkey Point, which the NRC staff evaluated in its EIS for initial license renewal (NRC 2002a). Subsequently, FPL updated its SAMA analysis in its ER for subsequent license renewal (FPL 2018f), which the NRC staff evaluated in its 2019 FSEIS on a site-specific basis (NRC 2019a). Finally, the NRC staff conducted a further evaluation of new and significant information for Turkey Point as it relates to population dose risk, as described in Appendix D of this EIS. As discussed in Appendix D, based on a site-specific evaluation, the staff NRC has concluded that the probability-weighted consequences of severe accidents from continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.14 Waste Management

As a result of normal operations, equipment repairs and replacements, and normal maintenance activities, nuclear power plants routinely generate both radioactive and nonradioactive waste. Nonradioactive waste includes hazardous and nonhazardous waste. There is also a class of waste, called mixed waste, that is both radioactive and hazardous. The NRC licenses all nuclear power plants with the expectation that they will release some radioactive material to both the air and water during normal operations. However, NRC regulations require that gaseous and liquid radioactive releases from nuclear power plants meet radiation dose-based limits specified in 10 CFR Part 20 and the ALARA criteria in 10 CFR Part 50, Appendix I. In other words, the NRC places regulatory limits on the radiation dose that members of the public can receive from a nuclear power plant's radioactive effluent. For this reason, all nuclear power plants use radioactive waste management systems to control and monitor radioactive wastes. FPL uses its Offsite Dose Calculation Manual (ODCM) that contains the methods and parameters for calculating offsite doses resulting from liquid and gaseous radioactive effluents. These methods ensure that radioactive material discharges from Turkey Point meet NRC and EPA regulatory dose standards. The ODCM also contains the requirements for the REMP. Turkey Point will produce both radioactive and nonradioactive waste during the SLR term like any operating nuclear power plant. The following sections address the site-specific environmental impacts of Turkey Point SLR on five environmental issues related to waste management.

### 2.14.1 Low-Level Waste Storage and Disposal

At Turkey Point, low-level radioactive waste is stored temporarily onsite before being shipped offsite for treatment or disposal at licensed treatment and disposal facilities (NRC 2019a). Annual quantities of low-level radioactive waste generated at Turkey Point vary from year to year depending on the number of maintenance activities undertaken. Due to the comprehensive regulatory controls in place for the management of radioactive waste, FPL's compliance with these regulations, and FPL's use of licensed treatment and disposal facilities, the impacts of

radioactive waste are expected to be SMALL during the SLR term. There are no other operating nuclear power plants, fuel-cycle facilities, or radiological waste treatment and disposal facilities within a 50 mi (80 km) radius of Turkey Point. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the environmental impacts from low-level waste storage and disposal due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.14.2 Onsite Storage of Spent Nuclear Fuel

As discussed in the FSEIS, Turkey Point's spent fuel is stored in a spent fuel pool and in an onsite independent spent fuel storage installation (ISFSI) (NRC 2019a). The Turkey Point onsite ISFSI is licensed under the general license provided to nuclear power plant licensees under 10 CFR 72.210, "General license issued." The NRC's regulations and its oversight of onsite spent fuel storage ensure that the increased volume in onsite storage from operation during the SLR term can be safely accommodated with little environmental effect. The ISFSI safely stores spent fuel onsite in licensed and approved dry cask storage containers. FPL indicated that there are plans as part of SLR to expand the concrete pad inside the ISFSI area to accommodate more fuel casks.

This issue was also considered for the NRC staff's environmental review of Turkey Point's initial license renewal, and no new and significant information was found at that time (NRC 2002a). The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the environmental impacts from onsite storage of spent nuclear fuel due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

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

As related to the issue of offsite radiological impacts of spent nuclear fuel and high-level waste disposal, a history of the NRC's Waste Confidence activities is provided in NUREG–2157, "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," Section 1.1, "History of Waste Confidence" (NRC 2014a). The management and ultimate disposition of spent nuclear fuel is limited to the findings codified in the September 19, 2014, Continued Storage of Spent Nuclear Fuel, Final Rule (79 FR 56238) and associated NUREG–2157. As stated in 10 CFR 51.23, the Commission has generically determined that the environmental impacts of continued storage of spent nuclear fuel beyond the licensed life for operation of a reactor are those impacts identified in NUREG-2157. The ultimate disposal of spent nuclear fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this site-specific review. In 10 CFR Part 51, Subpart A, the Commission concluded that the impacts presented in NUREG–2157 would not be sufficiently large to require the conclusion, for any nuclear power plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the offsite radiological impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants pursuant to 10 CFR 51.23 and does not warrant a site-specific analysis for the continued nuclear power plant operations at Turkey Point during the SLR term.

### 2.14.4 Mixed-Waste Storage and Disposal

Mixed waste, regulated under the Resource Conservation and Recovery Act of 1976, as amended (RCRA; 42 U.S.C. 6901 et seq.), and the AEA, is waste that is both radioactive and hazardous (EPA 2019). Mixed waste is subject to dual regulation: by the EPA or an authorized State for its hazardous component and by the NRC or an agreement state for its radioactive component. Similar to hazardous waste, mixed waste is generally accumulated onsite in designated areas as authorized under RCRA and then shipped offsite for treatment as appropriate and for disposal. Occupational exposures and any releases from the onsite treatment of these and any other types of wastes are considered when evaluating compliance with the applicable Federal standards and regulations; for example, 10 CFR Part 20, 40 CFR Part 190, and 10 CFR Part 50, Appendix I. Due to the comprehensive regulatory controls in place for the management of mixed waste, FPL's compliance with these regulations, and FPL's use of licensed treatment and disposal facilities, the impacts of mixed waste are expected to be SMALL during the SLR term. The NRC staff identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the radiological and nonradiological environmental impacts from mixed-waste storage and disposal due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.14.5 Nonradioactive Waste Storage and Disposal

Like any other industrial facility, nuclear power plants generate wastes that are not contaminated with either radionuclides or hazardous chemicals. Turkey Point has a nonradioactive waste management system to handle its nonradioactive hazardous and nonhazardous wastes. The waste is managed in accordance with FPL's procedures. Waste minimization and pollution prevention are important elements of operations at all nuclear power plants. Licensees are required to consider pollution prevention measures as dictated by the Pollution Prevention Act (Public Law 101-508) and RCRA. In addition, as discussed in detail in the FSEIS (NRC 2019a), Turkey Point has a nonradioactive waste management program to handle nonradioactive waste in accordance with Federal, State, and corporate regulations and procedures. Turkey Point will continue to store and dispose of nonradioactive hazardous and nonhazardous waste in accordance with EPA, State, and local regulations in permitted disposal facilities. With respect to unplanned, nonradiological releases, FPL reported no accidental spills or similar releases of nonradioactive substances, including petroleum products, at Turkey Point over the past 5 years, or any associated notices of violation issued to FPL for such releases (FPL 2023a). The NRC staff's review of available information and regulatory databases found no documented instances of accidental spills of chemical or petroleum products to groundwater that resulted in a regulatory action over the last 5 years. Due to the comprehensive regulatory controls in place for the management of nonradioactive waste and FPL's compliance with these regulations, the impacts of nonradioactive waste are expected to be SMALL during the SLR term. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the environmental impacts from nonradioactive waste storage and disposal due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.15 Uranium Fuel Cycle

The uranium fuel cycle includes uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level and high-level wastes related to uranium

fuel cycle activities. The NRC evaluated the environmental impacts of operating uranium fuel-cycle facilities, not including nuclear power plants, in two NRC publications: WASH-1248, "Environmental Survey of the Uranium Fuel Cycle" (AEC 1974), and NUREG–0116, "Environmental Survey of the Reprocessing and Waste Management Portions of the LWR [Light-Water Reactor] Fuel Cycle" (NRC 1976). More recently, facilities for managing the back end of the uranium fuel cycle were considered in NUREG–2157 (NRC 2014a). As evaluated in NUREG–2157, the NRC reaffirmed in 2014 that geological disposal remains technically feasible and that acceptable sites can be identified.

The impacts associated with uranium mining, milling, and the transportation of radioactive materials among facilities, including the transportation of wastes to disposal facilities, were incorporated into the NRC's regulations at 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data (Normalized to model LWR annual fuel requirement [ASH-1248] or reference reactor-year [NUREG-0116])." Specific categories of natural resource use included in Table S-3 include land use; water consumption and thermal effluents; radioactive releases; burial of transuranic waste, high-level waste, and low-level waste; and radiation doses from transportation and occupational exposures. 10 CFR 51.51(a) states that environmental reports related to the construction of nuclear power plants shall include Table S-3.

The environmental impacts associated with transporting fresh fuel to one model LWR and with transporting spent fuel and radioactive waste (low-level waste and mixed waste) from that LWR are provided in 10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste To and From One Light-Water-Cooled Nuclear Power Reactor." 10 CFR 51.52, "Environmental effects of transportation of fuel and waste—Table S-4," requires the consideration of Table S-4 in environmental reports related to the construction of nuclear power plants.

Nuclear fuel is needed for the operation of nuclear power plants during the SLR term in the same way that it is needed during the initial license term. Therefore, the factors that affect the data presented in Tables S-3 and S-4 do not change whether a nuclear power plant is operating under its initial license or a subsequent renewed license. The following sections address the site-specific environmental impacts of Turkey Point SLR on four environmental issues related to the uranium fuel cycle.

### 2.15.1 Offsite Radiological Impacts – Individual Impacts from Other than the Disposal of Spent Fuel and High-Level Waste

The primary indicators of offsite radiological impacts on individuals who live near uranium fuel cycle facilities are the concentrations of radionuclides in the effluents from the fuel-cycle facilities and the radiological doses received by an MEI on the site boundary or at some location away from the site boundary. The basis for establishing the significance of individual effects is the comparison of the releases in the effluents and the MEI doses with the permissible levels in applicable regulations. The analyses performed by the NRC in the preparation of Table S-3 indicate that if the facilities operate under a valid license issued by either the NRC or an agreement State, the individual effects will meet the applicable regulations. Based on these considerations, the NRC has concluded that the impacts on individuals from radioactive gaseous and liquid releases during the SLR term would remain at or below the NRC's regulatory limits. Efforts needed to keep releases and doses ALARA will continue to apply to fuel-cycle-related activities. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that offsite radiological impacts of the uranium fuel cycle (individual effects from

sources other than the disposal of spent fuel and high-level waste) due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.15.2 Offsite Radiological Impacts – Collective Impacts from Other than the Disposal of Spent Fuel and High-Level Waste

The focus of this issue is the collective radiological doses to and health impacts on the public resulting from uranium fuel cycle facilities during the SLR term. The radiological doses received by the public are calculated based on releases from the uranium fuel-cycle facilities to the environment, as provided in Table S-3. These estimates were provided in the 1996 LR GEIS for the gaseous and liquid releases listed in Table S-3 as well as for radon-222 and technetium-99 releases (Rn-222 and Tc-99), which are not listed in Table S-3. The population dose commitments were normalized for each year of operation of the model nuclear power plant (reference reactor-year).

Based on the analyses provided in the 1996 LR GEIS, the estimated involuntary 100-year dose commitment to the U.S. population resulting from the radioactive gaseous releases from uranium fuel-cycle facilities (excluding the nuclear power plants and releases of Rn-222 and Tc-99) was estimated to be 400 person-rem (4 person-Sv) per reference reactor-year. Similarly, the environmental dose commitment to the U.S. population from the liquid releases was estimated to be 200 person-rem (2 person-Sv) per reference reactor-year. As a result, the total estimated involuntary 100-year dose commitment to the U.S. population from radioactive gaseous and liquid releases listed in Table S-3 was given as 600 person-rem (6 person-Sv) per reference reactor-year (see Section 6.2.2 of the 1996 LR GEIS).

The doses received by most members of the public would be so small that they would be indistinguishable from the variations in natural background radiation. There are no regulatory limits applicable to collective doses to the public from fuel cycle facilities. All regulatory limits are based on individual doses. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits.

Based on its consideration of the available information, the Commission concluded that these impacts are acceptable in that they would not be sufficiently large to require the conclusion, for any nuclear power plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, the Commission has not assigned a single level of significance for the collective effects of the fuel cycle. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that offsite radiological impacts of the uranium fuel cycle (collective impacts from other than the disposal of spent fuel and high-level waste) due to continued nuclear power plant operations at Turkey Point during the SLR term would not be sufficiently large to require the conclusion that the option of Turkey Point SLR should be eliminated.

### 2.15.3 Nonradiological Impacts of the Uranium Fuel Cycle

Nonradiological impacts associated with the uranium fuel cycle as they relate to license renewal are provided in Table S-3. The significance of the environmental impacts associated with land use, water use, fossil fuel use, and chemical effluents were evaluated in the 1996 LR GEIS based on several relative comparisons. The land requirements were compared to those for a coal-fired power plant that could be built to replace the nuclear capacity if the operating license is not renewed. Water requirements for the uranium fuel cycle were compared to the annual requirements for a nuclear power plant. The amount of fossil fuel (coal and natural gas)

consumed to produce electrical energy and process heat during the various phases of the uranium fuel cycle was compared to the amount of fossil fuel that would have been used if the electrical output from the nuclear power plant were supplied by a coal-fired plant. Similarly, the gaseous effluents $SO_2$, nitric oxide (NO), hydrocarbons, carbon monoxide (CO), and other particulate matter (PM) released because of the coal-fired electrical energy used in the uranium fuel cycle were compared with equivalent quantities of the same effluents that would be released from a 45-megawatt electric coal-fired plant. It was noted that the impacts associated with uses of all resources would be SMALL. Any impacts associated with nonradiological liquid releases from the fuel-cycle facilities would also be SMALL. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the aggregate nonradiological impacts of the uranium fuel cycle due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### 2.15.4 Transportation

The environmental impacts associated with the transportation of nuclear fuel and waste to and from one model nuclear power plant as they relate to license renewal are addressed in Table S-4. Table S-4 forms the basis for analysis of the environmental impacts of the transportation of nuclear fuel and waste when evaluating applications for nuclear power plant license renewal. The applicability of Table S-4 to license renewal applications was extensively evaluated in the 1996 LR GEIS (NRC 1996) and its Addendum 1 (NRC 1999). The environmental impacts from the transportation of fuel and waste attributable to license renewal were found to be SMALL when they are within the parameters identified in 10 CFR 51.52. The NRC staff has identified no information or situations that would result in different impacts for this issue for the SLR term at Turkey Point and determined that Turkey Point is within the parameters identified in 10 CFR 51.52. Therefore, the NRC staff concludes that the transportation impacts of the uranium fuel cycle due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## 2.16 Termination of Nuclear Power Plant Operations and Decommissioning

The following section addresses the site-specific environmental impacts of Turkey Point SLR on one environmental issue related to termination of nuclear power plant operations and decommissioning.

### 2.16.1 Termination of Plant Operations and Decommissioning

The decommissioning process begins when a licensee informs the NRC that it has permanently ceased reactor operations, defueled, and intends to decommission the nuclear power plant. The licensee may also notify the NRC of the permanent cessation of reactor operations prior to the end of the license term. Consequently, most nuclear power plant activities and systems dedicated to reactor operations would cease after reactor shutdown. The environmental impacts of decommissioning a nuclear power plant are evaluated NUREG–0586, “Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors” (NRC 2002b). The NRC staff determined that license renewal would have a negligible effect on these impacts of terminating operations and decommissioning on all resources. The NRC staff has identified no information or situations that would result in different environmental impacts for this issue for the SLR term at Turkey Point. Therefore, the NRC staff concludes that the incremental environmental impacts of terminating plant operations and decommissioning due to continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

# 3 CONCLUSION

This environmental impact statement (EIS), together with the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (FSEIS), contains the U.S. Nuclear Regulatory Commission (NRC) staff's environmental review of the Florida Power & Light Company (FPL) subsequent license renewal (SLR) application, as supplemented, for Turkey Point Nuclear Generating Unit Nos. 3 and 4. This chapter of the EIS briefly summarizes the environmental impacts of Turkey Point SLR, the environmental impacts of alternatives to Turkey Point SLR, and the NRC staff's preliminary recommendation regarding its environmental review of Turkey Point SLR. The NRC staff's final recommendation will be presented in the staff's final EIS, which will be issued after the staff's consideration of public comments on this draft EIS.

## 3.1 Environmental Impacts of the Proposed Federal Action

This EIS supplements the FSEIS evaluation of the environmental issues that were dispositioned as Category 1 issues (generic to all or a distinct subset of nuclear power plants) in the FSEIS by reference to Table B–1 in Appendix B to Subpart A of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," and NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (LR GEIS). Through the consideration of any significant new information, this EIS also updates the FSEIS evaluation of the environmental issues that were dispositioned as Category 2 issues (specific to individual nuclear power plants) in the FSEIS. Together, this EIS and the FSEIS evaluate, on a site-specific basis, all of the environmental impacts of continued operation during the SLR term of Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

After reviewing the environmental impacts of Turkey Point SLR in this EIS and the FSEIS, the NRC staff concludes that Turkey Point SLR would have SMALL impacts, with the following exceptions: (1) for groundwater quality degradation, the impact would be SMALL toMODERATE; (2) for groundwater use conflicts, the impact would be SMALL to MODERATE; and (3) for aquatic resources (impingement and entrainment and thermal impacts), the impact would be SMALL to MODERATE. The NRC staff considered mitigation measures for each issue, as applicable, and concludes that no additional mitigation measures would be warranted.

## 3.2 Comparison of Alternatives

As part of its environmental review, the NRC is required to consider reasonable alternatives to SLR and to evaluate the environmental impacts associated with each alternative. These alternatives can include other methods of power generation (replacement power alternatives), as well as not authorizing the operation of Turkey Point for an additional 20 years (the no-action alternative).

In Chapter 4, "Environmental Consequences and Mitigating Actions," of the FSEIS, the NRC staff initially considered 16 replacement power alternatives but later dismissed 13 of them because of technical, resource availability, or commercial limitations that existed at that time, and that the NRC staff believed are likely to still exist when the Turkey Point subsequent

renewed licenses expire. This left the following three feasible and commercially viable replacement power alternatives:

- new nuclear power
- natural gas combined-cycle power
- a combination of new natural gas combined-cycle and new solar photovoltaic power.

The NRC staff evaluated these alternatives, along with the no-action alternative, in depth in Chapter 4 of the FSEIS (NRC 2019a). Additionally, the NRC staff evaluated an alternative cooling water system to mitigate potential impacts associated with the continued use of the existing cooling canal system. Finally, Appendix F of the FSEIS evaluated any new and significant information that could alter the conclusions of the site-specific severe accident mitigation alternatives (SAMA) analysis that was performed previously in connection with the initial license renewal of Turkey Point. In developing this EIS, the NRC staff has identified no significant new information that would change these discussions in the FSEIS.

Based on the evaluation in the FSEIS, as supplemented by this EIS, the NRC staff concludes that the environmentally preferred alternative is the proposed action of authorizing SLR for Turkey Point (i.e., operation for a period of 20 years beyond the expiration dates of the initial renewed licenses—i.e., until July 19, 2052, for Turkey Point Unit 3 and April 10, 2053, for Turkey Point Unit 4). As shown in Table 2-2, "Summary of Environmental Impacts of the Proposed Action and Alternatives," of the FSEIS, all of the reasonable power-generation alternatives have impacts in at least two resource areas that are greater than the impacts of SLR, in addition to the environmental impacts inherent to new construction projects. To make up the lost power generation if the NRC does not authorize operation for the SLR period (i.e., the no-action alternative), energy decision-makers may implement one of the replacement power alternatives discussed in the FSEIS, or a comparable alternative capable of replacing the power generated by Turkey Point.

## 3.3 Preliminary Recommendation

This EIS supplements the FSEIS evaluation of the environmental impacts of SLR for Turkey Point on a site-specific basis, and concludes that the environmental impacts of SLR, including new information and impacts that were previously dispositioned as Category 1 issues, do not warrant any modification to the NRC staff's previous determination in the FSEIS that the adverse environmental impacts of SLR for Turkey Point are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. Accordingly, the NRC staff's preliminary recommendation is that the adverse environmental impacts of SLR for Turkey Point Units 3 and 4 for an additional 20 years beyond the expiration dates of the initial renewed licenses are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable. The NRC staff bases this recommendation on the following:

- FPL's environmental report, as supplemented
- the NRC staff's consultation with Federal, State, Tribal, and local government agencies
- the NRC staff's independent environmental review, which is documented in the FSEIS and this EIS
- the NRC staff's consideration of public comments.

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# 5 LIST OF PREPARERS

Members of the U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards (NMSS) prepared this environmental impact statement with assistance from other NRC organizations. Table 5-1 identifies each contributor's name, education and experience, and function or expertise.

**Table 5-1 List of Preparers**

| Name | Education and Experience | Function or Expertise |
|---|---|---|
| Beth Alferink | MS Environmental Engineering; MS Nuclear Engineering; BS Nuclear Engineering; 25 years of national laboratory, industry, and government experience including radiation detection and measurements, nuclear power plant emergency response, operations, health physics, decommissioning, shielding and criticality | Human Health, Termination of Operations and Decommissioning, Radiological and Nonradiological Waste Management, Uranium Fuel Cycle, Spent Fuel |
| Briana Arlene | Master's Certification, National Environmental Policy Act; BS Conservation Biology; 18 years of experience in ecological impact analysis, Endangered Species Act Section 7 consultations, and Essential Fish Habitat consultations | Terrestrial Resources, Aquatic Resources, Federally Protected Ecological Resources, Cumulative Impacts |
| Lloyd Desotell | MS Civil Engineering; MS Water Resources Management; BA Environmental Studies; Over 20 years of experience conducting surface and subsurface hydrologic analyses | Surface Water Resources, Groundwater Resources |
| Jerry Dozier | M.S. Reliability Engineering; MBA Business Administration; BS Mechanical Engineering; 30+ years of experience including operations, reliability engineering, technical reviews, and NRC branch management | Postulated Accidents |
| Lifeng Guo | PhD Hydrogeology; MS Geology; BS Hydrogeology and Engineering Geology; Registered Professional Geologist; Over 30 years of combined experience in hydrogeologic investigation, hydrogeochemical analysis, and remediation | Surface Water Resources, Groundwater Resources, and Geologic Environment |
| Robert Hoffman | B.S. Environmental Resource Management; 37 years of experience in NEPA compliance, environmental impact assessment, alternatives identification and development, and energy facility siting | Replacement Power Alternatives, Air Quality, Noise |
| Nancy Martinez | BS Earth and Environmental Science; A.M. Earth and Planetary Science; 11 years of experience in environmental impact analysis | Historic and Cultural Resources, Socioeconomics, Environmental Justice |

**Table 5-1 List of Preparers (Continued)**

| Name | Education and Experience | Function or Expertise |
|---|---|---|
| Philip Meyer | PhD Civil Engineering; BA Physics; 30 years relevant experience in subsurface hydrology and contaminant transport, including 15 years of experience in groundwater resource assessment and environmental impacts analysis | Groundwater Resources |
| Donald Palmrose | PhD Nuclear Engineering; MS Nuclear Engineering; BS Nuclear Engineering;<br>35 years of experience including operations on U.S. Navy nuclear powered surface ships, technical and NEPA analyses, nuclear authorization basis support for DOE, and NRC project management | Postulated Accidents, Radiological and Nonradiological Waste Management |
| Lance Rakovan | BS Engineering Physics; MS Nuclear Engineering; Project Management Professional (PMP); 25+ years project management experience; 20+ years of experience facilitating public NEPA interactions | Environmental Project Manager |
| Jeffrey Rikhoff | M.R.P. Regional Environmental Planning; MS Development Economics; BA English;<br>43 years of combined industry and Government experience in NEPA compliance for DOE Defense Programs/NNSA and Nuclear Energy, DoD, and DOI; project management; socioeconomics and environmental justice impact analysis, historic and cultural resource impact assessments, consultation with American Indian Tribes, and comprehensive land use and development planning studies | Land Use, Visual Resources, Air Quality and Noise, Cumulative Impacts |
| Ted Smith | MS Environmental Engineering; BS Electrical Engineering; 38 years of experience, including DOE Power Administration, support of site Environmental Management programs, and spent fuel management, oversight of U.S. Navy nuclear ships design, construction, and operation, NRC project management and management | Management Oversight |

# 6 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS ENVIRONMENTAL IMPACT STATEMENT ARE SENT

**Table 6-1 List of Agencies, Organizations, and Persons to Whom Copies of this Environmental Impact Statement Are Sent**

| Name | Affiliation |
|---|---|
| Ayres, Richard | Friends of the Earth |
| Bennett, Elise Pautler | Center for Biological Diversity |
| Bryan, Stephanie | Poarch Band of Creek Indians |
| Chase, Kelly | Florida State Historic Preservation Office |
| Cody, Sarah | Miami-Dade County Office of Historic Preservation |
| Cypress, Talbert | Miccosukee Tribe of Indians of Florida |
| Dean, William Kenneth | U.S. Environmental Protection Agency |
| Hayes, Dr. Rose | Citizen |
| Hill, David | The Muscogee (Creek) Nation |
| Johnson, Lewis | Seminole Nation of Oklahoma |
| Lotane, Alissa | Florida Division of Historical Resources |
| Nelson, Reid | Advisory Council on Historic Preservation |
| Nester, Lindsay | U.S. Fish and Wildlife Service |
| Osceola, Marcellus | Seminole Tribe of Florida |
| Pate, Haigler | U.S. National Park Service |
| Perez, Gano | The Muscogee Nation |
| Reiser, Caroline | Natural Resources Defense Council |
| Silverstein, Rachel | Miami Waterkeeper |
| Soweka, Robin | The Muscogee Nation |
| Sprinkle, James | Citizen |
| Strand, Dianne | Florida Power & Light Co. |
| Watson, Tracy | U.S. Environmental Protection Agency |

# APPENDIX A

# COMMENTS RECEIVED ON THE TURKEY POINT NUCLEAR GENERATING UNITS 3 AND 4 ENVIRONMENTAL REVIEW

## A.1 Comments Received During the Scoping Period

The scoping process for this site-specific environmental impact statement for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point) subsequent license renewal began in October 2022, in accordance with the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.). On October 7, 2022, the U.S. Nuclear Regulatory Commission (NRC) issued a notice of its intent to prepare an environmental impact statement and to conduct an environmental scoping process for subsequent license renewal of Turkey Point that was published in the *Federal Register* (87 FR 61104). Comments were received by email and through the regulations.gov website.

The NRC received comments during the scoping process, which identified important issues that were addressed by the NRC staff in this environmental impact statement. In accordance with the NRC's regulations, the scoping summary report provides a concise summary of the determinations and conclusions reached as a result of the scoping process and is available at Agencywide Documents Access and Management System Accession No. ML23198A271 (NRC 2023).

## A.2 References

87 FR 61104. October 7, 2022. "Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement Florida Power & Light Company Turkey Point Nuclear Generating Unit Nos. 3 and 4." *Federal Register*, Nuclear Regulatory Commission.

National Environmental Policy Act of 1969, as amended. 42 U.S.C. § 4321 et seq.

[NRC] U.S. Nuclear Regulatory Commission. 2023. *Environmental Impact Statement Scoping Process Summary Report Turkey Point Nuclear Generating Unit Nos. 3 and 4 Miami-Dade County, FL*. Rockville, Maryland. ADAMS Accession No. ML23198A271.

# APPENDIX B

# CONSULTATION CORRESPONDENCE

## B.1 Federally Protected Ecological Resources

Appendix C.1 of the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (NUREG–1437, Supplement 5, Second Renewal; NRC 2019) (FSEIS) describes the U.S. Nuclear Regulatory Commission (NRC) consultations concerning federally protected ecological resources protected under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.), Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 U.S.C. 1801 et seq.), and National Marine Sanctuaries Act of 1966, as amended (16 U.S.C. 1431 et seq.). Since the issuance of the FSEIS, the NRC staff engaged in reinitiated ESA consultation with the U.S. Fish and Wildlife Service (FWS) concerning the continued operation of Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point, Turkey Point Units 3 and 4). This section describes that consultation and Table B-1 lists the correspondence related to the consultation.

**Table B-1 Endangered Species Act Section 7 Consultation Correspondence with the U.S. Fish and Wildlife Service**

| Date | Description | ADAMS Accession No.[(a)] |
|---|---|---|
| Nov 18, 2021 | NRC to FWS, Request to reinitiate ESA Section 7 consultation for continued operation of Turkey Point | ML21307A152 |
| Mar 21, 2022 | FWS to NRC, Amendment to July 25, 2019, biological opinion for Turkey Point | ML22089A060 |
| Apr 19, 2022 | NRC to FPL, Transmittal of the FWS's March 21, 2022, amendment to the 2019 biological opinion for Turkey Point | ML22094A094 |

(a) Access these documents through the NRC's Agencywide Documents Access and Management System (ADAMS) at https://adams.nrc.gov/wba/

On November 18, 2021, the NRC staff requested to reinitiate consultation with the FWS under Section 7 of the ESA following two vehicular collision-related American crocodile (*Crocodylus acutus*) mortalities in calendar year 2021 that were associated with Turkey Point operations. These incidents exceeded the amount of allowable take of this species specified in the incidental take statement of the FWS's 2019 biological opinion.

As a result of the reinitiated consultation, the FWS revised the amount of allowable take of the American crocodile as follows:

> The proposed Project is expected to result in the incidental take of crocodiles in the form of harm from habitat loss and injuries or mortalities from vehicle collisions and/or plant operation. The [FWS] expects no more than three crocodiles be taken within a calendar year or ten crocodiles within a five-year period.

The eastern indigo snake (*Drymarchon couperi*) was not subject to this consultation, and the amount of allowable take for that species is unchanged.

## B.2 National Historic Preservation Act Section 106 Consultation

The National Historic Preservation Act of 1966, as amended (NHPA; 54 U.S.C. 300101 et seq.), requires Federal agencies to take into account the effects of their undertakings on historic properties and consult with applicable State and Federal agencies, Tribal groups, individuals, and organizations that have a demonstrated interest in the undertaking before taking action. Historic properties are defined as resources that are eligible for listing in the National Register of Historic Places. The historic preservation review process (Section 106 of the NHPA) is outlined in regulations issued by the Advisory Council on Historic Preservation in Title 36 of the *Code of Federal Regulations* (36 CFR) Part 800, "Protection of Historic Properties." In accordance with 36 CFR 800.8(c), "Use of the NEPA Process for Section 106 Purposes," the NRC has elected to use the NEPA process to comply with its obligations under Section 106 of the NHPA.

Table B-2 lists the chronology of consultation and consultation documents related to the NRC's NHPA Section 106 review of the Turkey Point subsequent license renewal application in this environmental impact statement. The NRC staff is required to consult with the noted agencies and organizations in accordance with the statute and regulations listed in the previous paragraph.

**Table B-2 National Historic Preservation Act Correspondence**

| Date | Sender and Recipient | Description | ADAMS Accession No. |
|---|---|---|---|
| October 12, 2022 | T. Smith, NRC, to S. Cody, Miami-Dade County Office of Historic Preservation | Request for Scoping Comments | ML22277A829 |
| October 12, 2022 | T. Smith, NRC, to R. Nelson, Advisory Council on Historic Preservation | Request for Scoping Comments | ML22277A828 |
| October 12, 2022 | T. Smith, NRC, to A.S. Lotane, Florida Division of Historical Resources | Request for Scoping Comments | ML22277A830 |
| October 12, 2022 | T. Smith, NRC, to T. Cypress, Miccosukee Tribe of Indians of Florida | Request for Scoping Comments | ML22277A831 |
| October 12, 2022 | T. Smith, NRC, to D. Hill, The Muscogee (Creek) Nation | Request for Scoping Comments | ML22277A831 |
| October 12, 2022 | T. Smith, NRC, to S. A. Bryan, Poarch Band of Creek Indians | Request for Scoping Comments | ML22277A831 |
| October 12, 2022 | T. Smith, NRC, to L. J. Johnson, Seminole Nation of Oklahoma | Request for Scoping Comments | ML22277A831 |
| October 12, 2022 | T. Smith, NRC, to M. W. Osceola, Seminole Tribe of Florida | Request for Scoping Comments | ML22277A831 |
| October 14, 2022 | R. Soweka, Muscogee (Creek) Nation, to N. Martinez, NRC | Re: Request for Scoping Comments | ML23103A048 |
| October 17, 2022 | G Perez, Muscogee (Creek) Nation, to N. Martinez, NRC | Re: Request for Scoping Comments | ML23103A032 ML22294A106 |
| November 7, 2022 | T. Cypress, Miccosukee Tribe of Indians of Florida, to T. Smith, NRC | Re: Request for Scoping Comments | ML22314A095 |
| November 28, 2022 | A. Slade, Florida Division of Historical Resources, to T. Smith, NRC | Re: Request for Scoping Comments | ML23103A047 |

## B.3 References

36 CFR Part 800. *Code of Federal Regulations*, Title 36, Parks, Forests, and Public Property, Part 800, "Protection of Historic Properties."

Endangered Species Act of 1973. 16 U.S.C. § 1531 et seq.

Magnuson-Stevens Fishery Conservation and Management Act. 16 U.S.C. § 1801 et seq.

National Historic Preservation Act of 1966, as amended. 54 U.S.C. § 300101 et seq.

National Marine Sanctuaries Act, as amended. 16 U.S.C. § 1431 et seq.

[NRC] U.S. Nuclear Regulatory Commission. 2019. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4*. NUREG-1437, Supplement 5, Second Renewal, Washington, D.C. ADAMS Accession No. ML19290H346.

# APPENDIX C

# CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological list of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and external parties as part of the agency's environmental review of the Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point) subsequent license renewal application in this environmental impact statement (EIS). This appendix does not include consultation correspondence or comments received. For a list and discussion of consultation correspondence, see Appendix B, "Consultation Correspondence," of this EIS. For comments received, see Appendix A, "Comments Received on the Turkey Point Nuclear Generating Units 3 and 4 Environmental Review," of this EIS. All documents are available electronically from the NRC's Public Electronic Reading Room found at https://www.nrc.gov/reading-rm.html. From that site, the public can gain access to the Agencywide Documents Access and Management System (ADAMS), which provides text and image files of the NRC's public documents. The ADAMS accession number for each document is included in the following table, which lists the environmental review correspondence, by date, beginning with the Florida Power & Light Company (FPL) Subsequent License Renewal Application – Appendix E Environmental Report Supplement 2 for Turkey Point.

**Table C-1 Environmental Review Correspondence**

| Date | Correspondence Description | ADAMS Accession No. |
|---|---|---|
| June 9, 2022 | Subsequent License Renewal Application – Appendix E Environmental Report Supplement 2 | ML22160A301 |
| September 28, 2022 | Letter to William D. Maher, Licensing Director - Nuclear Licensing Projects, FPL - Turkey Point Units 3 & 4 Subsequent License Renewal Application Supplement Environmental Review | ML22268A001 |
| November 18, 2022 | Turkey Point Nuclear Generating Station, Units 3 And 4 - License Renewal Regulatory Audit Regarding the Environmental Review of the Subsequent License Renewal Application Supplement | ML22321A323 |
| February 1, 2023 | Turkey Point Nuclear Generating Station, Units 3 and 4 Summary of the Environmental Remote Audit Related to the Review of the Subsequent License Renewal Application | ML23031A190 |
| March 3, 2023 | Response to Requests for Additional Information (RAIs) and Requests for Confirmation of Information (RCIs) Following Regulatory Audit of Subsequent License Renewal Application | ML23062A367 |
| April 26, 2023 | Memorandum of Understanding Between the NRC and the U.S. National Park Service | ML23117A022 |

# APPENDIX D

# SEVERE ACCIDENTS

This appendix discusses severe accidents. License renewal applicants consider the environmental impacts of severe accidents at nuclear power plants, their probability of occurrence, and potential means available to mitigate those accidents in severe accident mitigation alternatives (SAMA) analyses. The purpose of SAMA analyses is to identify design alternatives, procedural modifications, or training activities that may further reduce the risks of severe accidents at nuclear power plants and that are also potentially cost-beneficial to implement. SAMA analyses include the identification and evaluation of SAMAs that may reduce the radiological risk from a severe accident by preventing substantial core damage (i.e., preventing a severe accident) or by limiting releases from containment if substantial core damage occurs (i.e., mitigating the impacts of a severe accident) (NRC 2013).

As part of the initial license renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point), Florida Power & Light Company (FPL) submitted to the U.S. Nuclear Regulatory Commission (NRC, or the Commission) an environmental report (ER) that included a SAMA analysis for Turkey Point (FPL 2000). FPL based this SAMA analysis on (1) the Turkey Point probabilistic safety assessment (PSA) for total accident frequency, core damage frequency (CDF), and containment large early release frequency; and (2) a supplemental analysis of offsite consequences and economic impacts for risk determination. The Turkey Point PSA included a Level 1 analysis to determine the CDF from internally initiated events and a Level 2 analysis to determine containment performance during severe accidents. The offsite consequences and economic impacts analyses used the MELCOR Accident Consequence Code System 2 (MACCS2) code, Version 1.2, to determine the offsite risk impacts on the surrounding environment and the public. Inputs for the impacts analyses included plant/site-specific values for core radionuclide inventory, source term and release fractions, meteorological data, projected population distribution (based on 1990 census data, projected out to 2025), emergency response evacuation modeling, and economic data. To help identify and evaluate potential SAMAs, FPL considered insights and recommendations from SAMA analyses for other plants, potential plant improvements discussed in NRC and industry documents, and documented insights provided by Turkey Point staff.

In its environmental review of the initial license renewal for Turkey Point (NRC 2002), the NRC staff evaluated the potential environmental impacts of plant accidents and examined each SAMA (individually and, in some cases, in combination) to determine the SAMA's individual risk reduction potential. The NRC staff then compared this potential risk reduction against the cost of implementing the SAMA to quantify the SAMA's cost-benefit value. The NRC staff found that FPL used a systematic and comprehensive process for identifying potential plant improvements for Turkey Point and that its bases for calculating the risk reductions afforded by these plant improvements were reasonable and generally conservative. Further, the NRC staff found that FPL's estimates of the costs of implementing each SAMA were reasonable and consistent with estimates developed for other nuclear power plants. In addition, the NRC staff determined that FPL's cost-benefit comparisons were performed appropriately. The NRC staff concluded that FPL's SAMA methods and implementation of those methods were sound, and it agreed with FPL's conclusion that none of the candidate SAMAs were potentially cost-beneficial based on conservative treatment of costs and benefits.

As part of the subsequent license renewal (SLR) for Turkey Point, FPL submitted to the NRC an ER (FPL 2018a), which it supplemented by letter dated April 10, 2018 (FPL 2018b) that included a SAMA discussion. According to Table B–1 in Appendix B to Subpart A of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives" and according to 10 CFR 51.53(c)(3)(ii)(L), "[i]f the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided" in the ER. Therefore, in its ER, FPL did not provide another SAMA analysis for Turkey Point; instead, FPL evaluated areas of new and significant information that could affect the environmental impact of postulated severe accidents during the SLR period of extended operation, and possible new and significant information as it relates to SAMAs.

In its environmental review of the SLR for Turkey Point in the "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (NUREG–1437, Supplement 5, Second Renewal) (FSEIS), issued in October 2019, the NRC staff reviewed FPL's assessment of the significance of new information that relates to the prior SAMA analysis and determined that it was performed consistent with NRC-endorsed guidance. The NRC staff concluded that (1) there was no new and significant information related to the severe accidents at Turkey Point that would alter the conclusions reached in NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1 (2013 LR GEIS) or Turkey Point's previous SAMA analysis; and (2) actions taken by the NRC and the nuclear industry since the publication of NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 0 (1996 LR GEIS), on which the Turkey Point SAMA analysis was based, reinforce the conclusion that the probability-weighted consequences of a severe accident are SMALL for all nuclear power plants, as stated in the 2013 LR GEIS, and further reduce the likelihood of finding a cost-beneficial SAMA that would substantially reduce the severe accident risk at Turkey Point.

After the publication of the FSEIS, the Commission determined that the 1996 LR GEIS and the 2013 LR GEIS did not consider SLR and that, therefore, the NRC staff's environmental review for Turkey Point SLR was inadequate insofar as the staff relied upon the 1996 LR GEIS and the 2013 LR GEIS (NRC 2022a, 2022b, 2022c). Since the NRC staff's environmental review for Turkey Point SLR with respect to the issue of SAMAs relied in part on the 1996 LR GEIS and the 2013 LR GEIS, this appendix evaluates those aspects of the 1996 LR GEIS and 2013 LR GEIS on a site-specific basis. As a result, taken together, this environmental impact statement (EIS) and the FSEIS evaluate, on a site-specific basis, all of the SAMA-related environmental impacts of continued operations during the SLR term for Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and for Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

## D.1 Severe Accident Analysis

The NRC staff's evaluation of SAMAs with respect to the environmental review for Turkey Point SLR in the FSEIS was based, in part, on the generic analysis of the impacts of severe accidents in the 1996 LR GEIS and the 2013 LR GEIS, the conclusion from which is summarized in Table B–1 in Appendix B to Subpart A of 10 CFR Part 51 as follows:

> The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are SMALL for all plants.

### D.1.1 Turkey Point Relative Comparison to Other Plants

The 1996 LR GEIS concluded that the probability-weighted consequences and impacts of severe accidents at all nuclear power plants were SMALL compared to other risks to which the populations surrounding nuclear power plants are routinely exposed. As part of this generic conclusion, the 1996 LR GEIS conservatively predicted an estimated population dose risk (95 percent upper confidence bound dose in units of person-rem/reactor-year [RY]) to be 278 person-rem specifically for Turkey Point in Table 5.6. The Turkey Point predicted value in the 1996 LR GEIS is much less than the mean value (approximately 1,560 person-rem/RY) for all of the other nuclear power plants evaluated in the 1996 LR GEIS. This means that the predicted probability-weighted consequences of severe accidents specific to Turkey Point were far less than the mean value for all plants in the generic SMALL impact determination. This comparison to other nuclear power plants demonstrates the relative impact of severe accidents for Turkey Point, which reinforces the site-specific conclusion that the probability-weighted consequences of severe accidents for Turkey Point are SMALL.

Regarding severe accidents during the initial license renewal term, the NRC staff evaluated the information in the Turkey Point initial license renewal application in consideration of the probability-weighted consequences of severe accidents. FPL calculated a population dose risk of 22 person-rem/RY, using a Level 3 PRA analysis with site-specific Turkey Point values during the initial license renewal term. Thus, the ratio of the 1996 LR GEIS 95 percent upper confidence bound population dose risk (278 person-rem/RY) to FPL's calculated value (22 person-rem/RY) for initial license renewal is 13. This essentially means that the Turkey Point population dose risk value that was determined to be SMALL in the 1996 LR GEIS had since been reduced by 1.3 orders of magnitude. The value calculated for the Turkey Point initial license renewal demonstrates the magnitude of conservatism used in the 1996 LR GEIS predicted values. The more recent plant-specific information and the conservatism built into the 1996 LR GEIS methodology reinforces the NRC staff's site-specific conclusion that the probability-weighted consequences of severe accidents for Turkey Point are SMALL.

### D.1.2 Further Reduction in the Subsequent License Renewal Submittal

Regarding the SLR term, the NRC staff evaluated the information in the Turkey Point SLR application in consideration of the probability-weighted consequences of severe accidents and concluded that the aggregate risk impact decreased by a factor of 18.3 compared to the Turkey Point previous SAMA analysis for the initial license renewal term (FPL 2018c). The sources of new information were those that the NRC staff determined to be important to severe accident impacts and included new internal events, new external events, new source term information, use of the Biological Effects of Ionizing Radiation (BEIR) VII report (National Resource Council 2006) risk coefficients, spent fuel pool accidents, higher fuel burnup, low power and shutdown events, and population increase. Therefore, the NRC staff's review of the Turkey Point SLR application further reinforced the conclusion that the probability-weighted consequences of severe accidents for Turkey Point SLR are SMALL.

### D.1.3 Population

Section E.3.9.2, "Population Increase," of Appendix E to the 2013 LR GEIS discusses the impact of population increases on offsite dose and economic consequences, stating the following:

> The 1996 GEIS estimated impacts at the midyear of each plant's license renewal period (i.e., 2030 to 2050). To adjust the impacts estimated in the NUREGs and NUREG/CRs to the midyear of the assessed plant's license renewal period, the information (i.e., exposure indexes [EIs]) in the 1996 GEIS can be used. The EIs adjust a plant's airborne and economic impacts from the year 2000 to its midyear license renewal period based on population increases. These adjustments result in anywhere from a 5 to a 30 percent increase in impacts, depending upon the plant being assessed. Given the range of uncertainty in these types of analyses, a 5 to 30 percent change is not considered significant. Therefore, the effect of increased population around the plant does not generally result in significant increases in impacts.

Table 3.11-2, "County Populations Totally or Partially Included within a 50-Mile Radius of [Turkey Point]," of the ER submitted with the SLR application for Turkey Point (FPL 2018a) provides population information relevant to Turkey Point. As Table 3.11-2 shows, FPL estimated that in 2053 (i.e., at the end of the SLR term for Turkey Point Unit 4) the population within the 50-mile radius of Turkey Point will be 6,890,445. Assuming a uniform increase in population, the midyear population (2043) is projected to be 6,366,881 (37 percent higher for the four relevant counties during the SLR term). FPL's estimated population increase is slightly above the 30 percent range determined by the NRC in the 2013 LR GEIS to not be significant. However, as discussed in Section E.3.3 of the 2013 LR GEIS, more recent estimates using more comprehensive updated site-specific information give a significantly lower population dose risk than what was assumed in the 1996 LR GEIS. Specifically, for Turkey Point, the 1996 LR GEIS estimated risks of 278 person-rem/RY were much higher than the Turkey Point initial license renewal SAMA calculated population dose of 22 person-rem/RY. The ratio of the 1996 LR GEIS 95 percent upper confidence bound population dose to the initial license renewal calculated population dose demonstrates a reduction in risk of a factor of 13. The effect of this significant reduction (factor of 13) in the total population dose risk from a radiological release following a severe accident far exceeds the effect of the estimated population increase (factor of 1.37). Therefore, the NRC staff has determined that the effect of increased population around Turkey Point during the SLR term would not result in a significant increase in impacts of severe accidents for Turkey Point. Based on these considerations, the NRC staff concludes that despite a site-specific prediction of population increase, the probability-weighted consequences of severe accidents from continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

### D.1.4 Severe Accident Mitigation Alternatives

An analysis of SAMAs was performed for Turkey Point at the time of the initial license renewal. The NRC staff documented its review of this analysis in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Regarding Turkey Point Units 3 and 4." Any new and significant information that might alter the conclusions of that analysis was considered in the SLR application, as discussed below. No new and significant SAMAs were identified through FPL's use of the NRC-endorsed topical report Nuclear Energy Institute (NEI) 17-04, "Model SLR New and Significant Assessment Approach for SAMA," nor was any new and significant information regarding SAMAs identified by the NRC staff in the FSEIS.

In its evaluation of the significance of new information related to plant-specific SAMA analyses, the NRC staff considers new information to be significant if it provides a seriously different picture of the impacts of the Federal action under consideration. Thus, for mitigation alternatives

such as SAMAs, new information is significant if it indicates that a mitigation alternative would substantially reduce an impact of the Federal action on the environment. Consequently, with respect to SAMAs, new information may be significant if it indicates that a given potentially cost-beneficial SAMA would substantially reduce the impacts of a severe accident or the probability or consequences (risk) of a severe accident occurring.

As discussed in Section E.2.2 of the FSEIS, FPL stated in its ER submitted as part of its SLR application that it used the methodology in NEI 17-04 to evaluate new and significant information as it relates to the Turkey Point SLR SAMAs. By letter dated January 31, 2018, the NRC staff reviewed NEI 17-04 and found it acceptable for interim use, pending formal NRC endorsement of NEI 17-04 by incorporation into Regulatory Guide 4.2, Supplement 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications" (NRC 2018). In general, as discussed above, the NEI 17-04 methodology does not consider a potential SAMA to be significant unless it reduces by at least 50 percent the maximum benefit as defined in Section 4.5, "Total Cost of Severe Accident Risk/Maximum Benefit," of NEI 05-01, Revision A, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document."

NEI 17-04 describes a three-stage process for determining whether there is any "new and significant" information relevant to a previous SAMA analysis:

- **Stage 1:** The SLR applicant uses Probabilistic Risk Assessment risk insights and/or risk model quantifications to estimate the percent of reduction in the maximum benefit associated with (1) all unimplemented "Phase 2" SAMAs for the analyzed plant and (2) those SAMAs identified as potentially cost-beneficial for other U.S. nuclear power plants and that are applicable to the analyzed plant. If one or more of those SAMAs are shown to reduce the maximum benefit by 50 percent or more, then the applicant must complete Stage 2. (Applicants that are able to demonstrate through the Stage 1 screening process that there is no potentially significant new information are not required to perform the Stage 2 or Stage 3 assessments).
- **Stage 2:** The SLR applicant develops updated averted cost-risk estimates for implementing those SAMAs. If the Stage 2 assessment confirms that one or more SAMAs reduce the maximum benefit by 50 percent or more, then the applicant must complete Stage 3.
- **Stage 3:** The SLR applicant performs a cost-benefit analysis for the "potentially significant" SAMAs identified in Stage 2.

The FSEIS describes FPL's application of the NEI 17-04 methodology to Turkey Point SAMAs. FPL determined that none of the SAMAs evaluated in Stage 1 reduced the maximum benefit by 50 percent or more. As a result, FPL concluded that it is not required to perform the Stage 2 or Stage 3 evaluations for any Turkey Point SAMAs.

As provided in the FSEIS, the NRC staff reviewed FPL's new and significant information analysis for severe accidents and SAMAs at Turkey Point during the SLR term and found the analysis and the methods used to be reasonable. The NRC staff concluded that given the low residual risk at Turkey Point, the substantial decrease in CDF at Turkey Point since the previous SAMA analysis, and the fact that no potentially cost-beneficial SAMAs were identified during the Turkey Point initial license renewal review, it is unlikely that FPL would have found any potentially cost-beneficial SAMAs for the SLR term. Further, FPL's implementation of actions to satisfy the NRC's orders and regulatory requirements regarding beyond design basis events after the terrorist attacks of September 11, 2001, and the Fukushima Dai-Ichi accident, as well as the conservative assumptions used in earlier severe accident studies and SAMA analyses,

also made it unlikely that FPL would have found any potentially significant cost-beneficial SAMAs during the SLR term. For these reasons, the NRC staff concluded that the conclusions reached by FPL in its SLR application regarding SAMAs were reasonable and that there is no new and significant information regarding any potentially cost-beneficial SAMAs that would substantially reduce the risks of a severe accident at Turkey Point.

The NRC staff determined that all other sources of new information (e.g., new meteorological information, new emergency preparedness information, etc.) do not contribute sufficiently to impacts to warrant their inclusion in the severe accident analysis, especially given the factor of 18.3 reduction in risk over the prior analyses and the small likelihood of finding cost-effective plant improvements from other new information sources. This aggregate risk reduction from new sources of information supports the 2013 LR GEIS conclusions for severe accidents for the SLR term (NRC 2019a, Appendix E.3.10) and supports the conclusion that the probability-weighted consequences of severe accidents from continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

As explained above, plant-specific calculations performed during the initial Turkey Point license renewal SAMA analysis demonstrated a reduction of 1.3 orders of magnitude from the conservatively predicted population dose risk value for Turkey Point in the 1996 LR GEIS (in which the probability-weighted consequences of severe accidents were determined to be SMALL). This reduction demonstrates the magnitude of conservatism used in the 1996 LR GEIS. Considering new Turkey Point plant-specific information since the Turkey Point SAMA analysis, the aggregate risk was found to be further decreased by a factor of 18.3 compared to the Turkey Point previous SAMA analysis. Therefore, the Turkey Point calculated population dose risk and more recent plant-specific information reinforces the NRC's 1996 determination that the probability-weighted consequences of severe accidents are SMALL. The NRC staff concludes that the probability-weighted consequences of severe accidents from continued operations at Turkey Point during the SLR term would be SMALL.

## D.2 Uncertainty

Section 5.3.3 in the 1996 LR GEIS provides a discussion of the uncertainties associated with the analysis in the GEIS and in the individual plant EISs used to estimate the environmental impacts of severe accidents. The 1996 LR GEIS used 95th percentile upper confidence bound estimates whenever available to estimate the environmental impacts of severe accidents. This approach provides conservatism to cover uncertainties, as described in Section 5.3.3.2.2 of the 1996 LR GEIS. Many of these same uncertainties also apply to the analysis used in the 2013 LR GEIS. As discussed in Sections E.3.1 through E.3.8 of the 2013 LR GEIS, the GEIS used more recent information to supplement the estimate of environmental impacts contained in the 1996 LR GEIS. In effect, the assessments contained in Sections E.3.1 through E.3.8 of the 2013 LR GEIS provided additional information and insights into certain areas of uncertainty associated with the 1996 LR GEIS. However, as provided in the 2013 LR GEIS, the impact and magnitude of uncertainties, as estimated in the 1996 LR GEIS, bound the uncertainties introduced by the new information and considerations addressed in the 2013 LR GEIS. Accordingly, in the 2013 LR GEIS, the NRC staff concluded that the reduction in environmental impacts resulting from the use of new information (since the 1996 LR GEIS analysis) outweighs any increases in impact resulting from the new information. As a result, the 2013 LR GEIS concluded that the findings in the 1996 LR GEIS remain valid.

The NRC staff has identified no new and significant information regarding uncertainties during its review of the Turkey Point SLR application, as supplemented, the SAMA audit, the scoping

process, or the evaluation of other available information. As discussed above, more recent Turkey Point plant-specific information demonstrates an overall reduction of the probability-weighted consequences of severe accidents compared to the 1996 LR GEIS. The NRC staff has not identified any new information pertaining to uncertainties compared to the uncertainties discussed in the 2013 LR GEIS, that would alter this conclusion for Turkey Point. Therefore, the NRC staff concludes that, upon considering uncertainties, the probability-weighted consequences of severe accidents from continued nuclear power plant operations at Turkey Point during the SLR term would be SMALL.

## D.3 References


[FPL] Florida Power & Light Company. 2000. Applicant's Environmental Report – Operating License Renewal Stage Turkey Point Units 3 and 4. Miami, Florida.

[NRC] U.S. Nuclear Regulatory Commission. 2002. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Turkey Point Plant Units 3 and 4, Final Report. NUREG–1437, Supplement 5. January 2002. 669 p. ADAMS Accession Nos. ML020280119, ML020280202, and ML020280226.

[FPL] Florida Power & Light Company. 2018a. Applicant's Environmental Report – Subsequent Operating License Renewal Stage – Turkey Point Nuclear Plant Units 3 and 4. January 2018. ADAMS Accession No. ML18037A836.

[FPL] Florida Power & Light Company. 2018b. Turkey Point Units 3 and 4 Subsequent License Renewal Application – Revision 1. April 10, 2018. ADAMS Package Accession No. ML18113A132.

[FPL] Florida Power & Light Company. 2018c. Turkey Point Units 3 and 4 Subsequent License Renewal Application. January 30, 2018. ADAMS Package Accession No. ML18037A812.

[FPL] Florida Power & Light Company. 2022. Subsequent License Renewal Application – Appendix E Environmental Report Supplement 2. June 9, 2022. 115 p. ADAMS Accession No. ML22160A301.

[NRC] U.S. Nuclear Regulatory Commission. 2013. Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the Occupational Safety and Health Administration. September 6, 2013. ADAMS Accession No. ML11354A432.

[NRC] U.S. Nuclear Regulatory Commission. 2018. Interim Endorsement of NEI 17-01, Industry Guidance for Implementing the Requirements of 10 CFR PART 54 for Subsequent License Renewal and NEI 17-04, Model SLR New and Significant Assessment Approach for SAMA. January 31, 2018. ADAMS Accession No. ML18029A368.

[NRC] U.S. Nuclear Regulatory Commission. 2019. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Draft Report for Comment. NUREG–1437, Supplement 5, Second Renewal. March 2019. 429 p. ADAMS Accession No. ML19078A330.

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# APPENDIX E

# ENVIRONMENTAL ISSUES AND IMPACT FINDINGS CONTAINED IN THE PROPOSED RULE, 10 CFR PART 51, "ENVIRONMENTAL PROTECTION REGULATIONS FOR DOMESTIC LICENSING AND RELATED REGULATORY FUNCTIONS"

The U.S. Nuclear Regulatory Commission (NRC, the Commission) staff prepared this site-specific environmental impact statement (EIS) to supplement the staff's final supplemental environmental impact statement (FSEIS), i.e., "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report" (NUREG–1437, Supplement 5, Second Renewal) (FSEIS; NRC 2019), issued in October 2019.

This EIS includes the NRC staff's site-specific evaluation of the environmental impacts of subsequent license renewal (SLR) for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (Turkey Point) requested by Florida Power & Light Company (FPL) for each of the environmental issues that were dispositioned as Category 1 issues (generic to all or a distinct subset of nuclear power plants) in the FSEIS. The FSEIS was issued as a supplement to NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 1, Final Report (the 2013 LR GEIS; NRC 2013). The 2013 LR GEIS and the associated revised rule (78 FR 37282) had identified 78 environmental impact issues, 61 of which were deemed to be generic Category 1 issues and 17 of which were deemed to be Category 2 issues that required a plant-specific analysis. The FSEIS followed that approach, consistent with Table B–1 in Appendix B to Subpart A of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions." In accordance with the Commission's decisions in Commission Legal Issuance (CLI)-22-02 and CLI-22-03, this EIS provides a site-specific evaluation of the issues that were treated as Class 1 issues in the FSEIS.

This EIS also considers whether there is any significant new information that would change the NRC staff's conclusions concerning Category 2 issues (specific to individual nuclear power plants) in the FSEIS. In CLI-22-02 and CLI-22-03, the Commission directed the NRC staff to modify the expiration dates of the Turkey Point subsequent renewed licenses, which were issued on December 4, 2019, to reflect the end dates of the previous renewed licenses (i.e., July 19, 2032, for Turkey Point Unit 3 and April 10, 2033, for Turkey Point Unit 4). Together, the EIS and the FSEIS evaluate, on a site-specific basis, all of the environmental impacts of continued operation during the SLR term for Turkey Point Unit 3 from July 19, 2032, to July 19, 2052, and for Turkey Point Unit 4 from April 10, 2033, to April 10, 2053.

On March 3, 2023, the NRC published a draft rule (88 FR 13329) proposing to amend its environmental protection regulations in 10 CFR Part 51. Specifically, the proposed rule would update the NRC's 2013 findings concerning the environmental impacts of renewing the operating license of a nuclear power plant, and specifically address SLR. The technical basis for the proposed rule is discussed in draft Revision 2 to NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (the 2023 LR GEIS; NRC 2023), which when finalized would update the 2013 LR GEIS; the 2013 LR GEIS, in turn, was an update of NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Revision 0 (the 1996 LR GEIS; NRC 1996). The 2023 LR GEIS when finalized

would support the proposed revised list of National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4321 et seq.), issues and associated environmental impact findings for license renewal (including SLR) to be contained in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51. The 2023 LR GEIS and proposed rule reflect lessons learned and knowledge gained from the NRC's conduct of environmental reviews for initial license renewal (LR) and SLR since 2013.

The 2023 proposed rule would redefine the number and scope of the environmental issues that must be addressed by the NRC during initial LR and SLR environmental reviews. In the 2013 rule, there were 78 environmental issues, 17 of which required a plant-specific analysis (Category 2 issues) during LR environmental reviews. The proposed rule identifies 80 environmental impact issues, 20 of which would require plant-specific analysis. The proposed rule would reclassify some previously site-specific (Category 2) issues as generic (Category 1) issues and would consolidate other issues. It would also add new Category 1 and Category 2 issues to Table B-1. In Section 1.10 of the 2023 LR GEIS, these proposed changes are summarized as follows.

- One Category 2 issue, "Groundwater quality degradation (cooling ponds at inland sites)," and a related Category 1 issue, "Groundwater quality degradation (cooling ponds in salt marshes)," would be consolidated into a single Category 2 issue, "Groundwater quality degradation (plants with cooling ponds)."
- Two related Category 1 issues, "Infrequently reported thermal impacts (all plants)" and "Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication," and the thermal effluent component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," would be consolidated into a single Category 1 issue, "Infrequently reported effects of thermal effluents."
- One Category 2 issue, "Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)," and the impingement component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," would be consolidated into a single Category 2 issue, "Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)."
- One Category 1 issue, "Impingement and entrainment of aquatic organisms (plants with cooling towers)," and the impingement component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," would be consolidated into a single Category 1 issue, "Impingement mortality and entrainment of aquatic organisms (plants with cooling towers)."
- One Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," would be divided into three Category 2 issues: (1) "Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction," (2) "Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction," and (3) "Magnuson-Stevens Act: essential fish habitat."
- Two new Category 2 issues, "National Marine Sanctuaries Act: sanctuary resources" and "Climate change impacts on environmental resources," would be added.
- One Category 2 issue, "Severe accidents," would be changed to a Category 1 issue.
- One new Category 1 issue, "Greenhouse gas impacts on climate change," would be added.

- Several issue titles and findings would be revised to clarify their intended meanings.

Finalization and publication of the 2023 LR GEIS and the proposed rule, is expected to occur in or about May 2024. Upon being finalized, the rule would revise the NRC's environmental protection regulations, as amended. Thereafter, the NRC would have to consider and analyze in its initial LR or SLR environmental reviews any significant impacts associated with Category 2 issues and, to the extent that there is any new and significant information, the potential impacts associated with Category 1 issues for the nuclear power plant LR application under review. To account for the possibility that the proposed rule and the 2023 LR GEIS may be finalized before a final determination is reached on FPL's SLR application, the NRC staff analyzes in this appendix, on a site-specific basis, the new and revised environmental issues described in the 2023 LR GEIS because they may apply to SLR for Turkey Point. Table E-1 lists the new and revised environmental issues that would apply to Turkey Point SLR. The sections that follow discuss how the NRC staff addressed each of these new and revised issues in this site-specific EIS and the FSEIS.

**Table E-1 New and Revised 10 CFR Part 51 License Renewal Environmental Issues**

| Issue | 2023 LR GEIS Section | Category |
|---|---|---|
| Groundwater quality degradation (plants with cooling ponds) | 4.5.1.2 | 2 |
| Infrequently reported effects of thermal effluents | 4.6.1.2 | 1 |
| Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) | 4.6.1.2 | 2 |
| Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction | 4.6.1.3.1 | 2 |
| Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction | 4.6.1.3.2 | 2 |
| Magnuson-Stevens Act: essential fish habitat | 4.6.1.3.3 | 2 |
| National Marine Sanctuaries Act: sanctuary resources | 4.6.1.3.4 | 2 |
| Severe accidents | 4.9.1.2.1 | 1 |
| Greenhouse gas impacts on climate change | 4.12.1 | 1 |
| Climate change impacts on environmental resources | 4.12.3 | 2 |

## E.1 Groundwater Quality Degradation (Plants with Cooling Ponds)

With respect to groundwater resources, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 by consolidating one Category 2 issue, "Groundwater quality degradation (plants with cooling ponds at inland sites)," and a related Category 1 issue, "Groundwater quality degradation (plants with cooling ponds in salt marshes)," into a single new Category 2 issue, "Groundwater quality degradation (plants with cooling ponds)." This consolidated issue considers the possibility of groundwater quality and beneficial use becoming degraded as a result of the migration of contaminants discharged to cooling ponds. The significance of the impact on groundwater would depend on site-specific conditions, including cooling pond water quality, site hydrogeologic conditions (including the interaction of surface water and groundwater), and the location, depth, and pump rate of water wells.

Section 2.8.3 of this EIS provides a site-specific analysis of groundwater quality degradation for plants that have cooling ponds in salt marshes. Based on this site-specific analysis, the NRC staff concludes that the impacts on groundwater quality from the Turkey Point cooling canal

system (CCS) due to continued nuclear power plant operations at Turkey Point during the SLR term would be MODERATE. Therefore, the issue "Groundwater quality degradation (plants with cooling ponds)" has been addressed in this EIS.

## E.2 Infrequently Reported Effects of Thermal Effluents

The draft rule proposes to combine two Category 1 issues, "Infrequently reported thermal impacts (all plants)" and "Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication," and the thermal effluent component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," into one Category 1 issue, "Infrequently reported effects of thermal effluents." This issue pertains to interrelated and infrequently reported effects of thermal effluents, including cold shock, thermal migration barriers, accelerated maturation of aquatic insects, and proliferated growth of aquatic nuisance species, as well as the effects of thermal effluents on dissolved oxygen, gas supersaturation, and eutrophication. This issue also considers sublethal stresses associated with thermal effluents that can increase the susceptibility of exposed organisms to predation, parasitism, or disease. These changes do not introduce any new environmental issues; rather, the proposed rule would reorganize existing issues. The changes are fully summarized and explained in Section 4.6.1.2 of the 2023 LR GEIS and in the proposed rule.

Sections 2.10.2, 2.10.3, and 2.10.9 of this EIS analyze infrequently reported effects of thermal effluents for Turkey Point SLR and conclude that the impacts would be SMALL. Therefore, the issue "Infrequently reported effects of thermal effluents" has been addressed in this EIS.

## E.3 Impingement Mortality and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

The draft rule proposes to combine the Category 2 issue, "Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)," and the impingement component of the Category 1 issue, "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses," into one Category 2 issue, "Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)." This issue pertains to impingement mortality and entrainment of finfish and shellfish at nuclear power plants with once-through cooling systems and cooling ponds during the LR term (either initial LR or SLR). This includes plants with helper cooling towers that are seasonally operated to reduce thermal load to the receiving water body, reduce entrainment during peak spawning periods, or reduce consumptive water use during periods of low river flow.

In the 2023 LR GEIS, the NRC renamed this issue to specify impingement mortality, rather than simply impingement. This change is consistent with the U.S. Environmental Protection Agency (EPA) 2014 Clean Water Act (CWA) Section 316(b) regulations and the EPA's assessment that impingement reduction technology is available, feasible, and has been demonstrated to be effective. Additionally, the EPA's 2014 CWA Section 316(b) regulations establish best technology available standards for impingement mortality based on the fact that survival is a more appropriate metric for determining environmental impact rather than simply looking at total impingement. Therefore, the 2023 LR GEIS also consolidates the impingement component of the "Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses" issue for plants with once-through cooling systems or cooling ponds into this issue.

Section 4.7.1 of the FSEIS (NRC 2019) analyzed the impacts of impingement and entrainment for Turkey Point SLR. The analysis considered the components of the proposed revision to this issue, impingement mortality, and the impingement component of losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. In the FSEIS, the NRC staff concluded that impingement and entrainment during the SLR term would be of SMALL to MODERATE significance on the aquatic organisms of the Turkey Point CCS. With respect to aquatic organisms in Biscayne Bay and connected water bodies (e.g., Card Sound, the Atlantic Ocean), the NRC staff concluded that the issue of impingement and entrainment during the SLR term does not apply because there are no surface water connections that allow flow between the waters of the Biscayne Bay and the CCS and, therefore, organisms inhabiting these waters never interact with the Turkey Point intake structure. Therefore, this issue has been considered, as appropriate, for Turkey Point SLR.

## E.4 Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife Jurisdiction

The draft rule proposes to divide the Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," into three separate Category 2 issues for clarity and consistency with the separate Federal statues and interagency consultation requirements that the NRC must consider with respect to federally protected ecological resources. When combined, however, the scope of the three issues is the same as the scope of the former "Threatened, endangered, and protected species and essential fish habitat" issue discussed in the 2013 LR GEIS. As discussed below, such impacts were considered on a site-specific basis in the Turkey Point FSEIS for SLR.

The first of the three issues, "Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction," concerns the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on federally listed species and critical habitats protected under the Endangered Species Act (ESA) and under the jurisdiction of the U.S. Fish and Wildlife Service (FWS).

Section 4.8.1.1 of the Turkey Point FSEIS (NRC 2019) addresses the impacts of Turkey Point SLR on federally listed species and critical habitats under FWS jurisdiction. That section, along with Appendix C.1 of the FSEIS, describes impacts on federally listed terrestrial and freshwater species and critical habitats, as well as ESA consultation between the NRC and the FWS, which resulted in the FWS's issuance of a biological opinion for the American crocodile (*Crocodylus acutus*) and eastern indigo snake (*Drymarchon corais couperi*). The NRC and the FWS determined that Turkey Point SLR is likely to adversely affect the American crocodile and the eastern indigo snake. With respect to critical habitat, the FSEIS determined that Turkey Point SLR is not likely to adversely modify designated critical habitat for the West Indian manatee (*Trichechus manatus*) but may adversely modify designated critical habitat for the American crocodile. Section B.1 in Appendix B of this EIS describes reinitiated consultation, which the NRC undertook because FPL exceeded the incidental take limit for crocodiles set forth in the FWS's biological opinion. As a result of the reinitiated consultation, the FWS amended the biological opinion.

Accordingly, the issue "Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife jurisdiction," has been considered for Turkey Point SLR.

## E.5 Endangered Species Act: Federally Listed Species and Critical Habitats Under National Marine Fisheries Service Jurisdiction

As explained in the previous section, the draft rule proposes to divide the Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," into three separate Category 2 issues. The second of the three issues, "Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction," concerns the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on federally listed species and critical habitats protected under the ESA and under the jurisdiction of the National Marine Fisheries Service (NMFS).

Section 4.8.1.1 of the Turkey Point FSEIS (NRC 2019) addresses the impacts of Turkey Point SLR on federally listed species and critical habitats under NMFS jurisdiction. That section, along with Section C.1 in Appendix C of the FSEIS, describes impacts on federally listed marine species and critical habitats, as well as ESA consultation between the NRC and the NMFS, which resulted in the NMFS's concurrence with the NRC's finding that Turkey Point SLR is not likely to adversely affect any listed marine species. Accordingly, this issue has been considered for Turkey Point SLR.

## E.6 Magnuson-Stevens Act: Essential Fish Habitat

As explained above, the draft rule proposes to divide the Category 2 issue, "Threatened, endangered, and protected species and essential fish habitat," into three separate Category 2 issues. The third of the three issues, "Magnuson-Stevens Act: essential fish habitat," concerns the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on essential fish habitat protected under the Magnuson-Stevens Act (MSA).

Section 4.8.1.2 of the Turkey Point FSEIS (NRC 2019) addresses the impacts of Turkey Point SLR on essential fish habitat (EFH). That section, along with Section C.2 in Appendix C of the FSEIS, describes impacts on EFH and that, although the NMFS has designated EFH for a number of federally managed species within Biscayne Bay, neither EFH nor the species themselves occur in the CCS or on the Turkey Point site because there are no surface water connections between the CCS and any natural water bodies and, therefore, Turkey Point SLR would not result in any impacts on EFH. Accordingly, the NRC was not required under the MSA to consult with the NMFS for the proposed action, and this issue has been considered for Turkey Point SLR.

## E.7 National Marine Sanctuaries Act: Sanctuary Resources

The draft rule proposes to add a new Category 2 issue, "National Marine Sanctuaries Act: sanctuary resources," to evaluate the potential effects of continued nuclear power plant operation and any refurbishment during the LR term on sanctuary resources protected under the National Marine Sanctuaries Act (NMSA).

Under the NMSA, the National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries (ONMS) designates and manages the National Marine Sanctuary System. Marine sanctuaries may occur near nuclear power plants located on or near marine waters as well as the Great Lakes.

Section 4.8.1.3 of the Turkey Point FSEIS (NRC 2019) addresses the impacts of Turkey Point SLR on sanctuary resources of the Florida Keys National Marine Sanctuary. That section, along

with Section C.3 in Appendix C of the FSEIS, describes impacts on sanctuary resources and concludes that Turkey Point SLR is not likely to destroy, cause the loss of, or injure any sanctuary resources. Accordingly, the NRC was not required under the NMSA to consult with the ONMS for the proposed action, and this issue has been considered for Turkey Point SLR.

## E.8 Severe Accidents

With respect to postulated accidents, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 by reclassifying the Category 2 "Severe accidents" issue as a Category 1 issue. In the 2013 LR GEIS, the issue of severe accidents was classified as a Category 2 issue to the extent that alternatives to mitigate severe accidents must be considered for all nuclear power plants where the licensee had not previously performed a severe accident mitigation alternatives (SAMA) analysis for the plant. In the 2023 LR GEIS, the NRC staff notes that this issue would be resolved generically for the vast majority, if not all, expected license renewal applicants because the applicants who will likely reference the LR GEIS have previously completed a SAMA analysis.

As discussed in Appendix D of this EIS, an analysis of SAMAs was performed for Turkey Point and evaluated by the NRC staff at the time of initial LR (NRC 2002). In the FSEIS and in Appendix D of this EIS, the NRC staff evaluated the significance of new information related to the plant-specific SAMA analysis. Therefore, the issue of "Severe accidents" has been addressed for Turkey Point SLR.

## E.9 Greenhouse Gas Impacts on Climate Change

With respect to greenhouse gas (GHG) emissions and climate change, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 by adding a new Category 1 issue "Greenhouse gas impacts on climate change." This new issue has an impact level of SMALL. This new issue considers GHG impacts on climate change from routine operations of nuclear power plants and construction vehicles and other motorized equipment used for refurbishment activities. GHG emissions from routine operations of nuclear power plants are typically very minor, because such plants, by their very nature, do not normally combust fossil fuels to generate electricity. However, nuclear power plant operations do have some GHG emission sources, including diesel generators, pumps, diesel engines, boilers, refrigeration systems, and electrical transmission and distribution systems, as well as mobile sources (e.g., worker vehicles and delivery vehicles). GHG emissions from construction vehicles and other motorized equipment for refurbishment activities would be intermittent and temporary, restricted to the refurbishment period. GHG emissions from continued operations and refurbishment activities are minor.

The issue of GHG impacts on climate change associated with nuclear power plant operations was not identified as either a generic or plant-specific issue in the 1996 LR GEIS or 2013 LR GEIS. In the 2013 LR GEIS, however, the NRC staff presented GHG emission factors associated with the nuclear power life cycle. Following the issuance of CLI-09-21 (NRC 2009), the NRC began to evaluate the effects of GHG emissions in plant-specific environmental reviews for LR applications. Accordingly, Section 4.15.3.1 of the FSEIS (NRC 2019) evaluates GHG emissions associated with the operation of Turkey Point during the SLR term. Table 4-6 of the FSEIS presents quantified annual GHG emissions from sources at Turkey Point for the 2012–2016 time period when operation of Turkey Point emits GHGs directly and indirectly. Turkey Point's direct GHG emissions result from stationary portable combustion sources and stationary refrigeration appliances. In response to an NRC staff request for additional

information, FPL provided updated GHG emissions from sources at Turkey Point, which are presented in Table E-2.

**Table E-2 Estimated Greenhouse Gas Emissions[(a)] from Operation at Turkey Point, Units 3 and 4**

| Year | Turkey Point Combustion Sources[(b)] (tons/year) | Workforce Commuting[(c)] (tons/year) | Total (tons/year) |
|---|---|---|---|
| 2017 | 460 | 3,345 | 3,800 |
| 2018 | 550 | 3,345 | 3,900 |
| 2019 | 575 | 3,345 | 3,900 |
| 2020 | 670 | 3,345 | 4,000 |
| 2021 | 530 | 3,345 | 3,870 |

Note: Greenhouse gas (GHG) emissions reported in metric tons and converted to short tons. All reported values are rounded. To convert tons per year to metric tons per year, multiply by 0.90718.

(a) Expressed in carbon dioxide equivalents ($CO_2$eq), a metric used to compare the emissions of GHGs based on their global warming potential (GWP). The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. $CO_2$eq is obtained by multiplying the amount of the GHG by the associated GWP. For example, the GWP of methane is 21; therefore, 1 ton of methane is equivalent to 21 tons of $CO_2$ emissions.

(b) Includes stationary and portable diesel and gasoline engines.

(c) Emissions consider Turkey Point full-time employees and do not include additional contractor workers during refueling outages. Refueling outages occur on a staggered, 18-month schedule and last approximately 25–35 days per unit.

Source: FPL 2023.

FPL has no plans to conduct major refurbishment during the Turkey Point SLR term and, therefore, no GHG emissions from refurbishment or increases in GHG emissions beyond current levels from routine operations at Turkey Point are anticipated. The NRC staff concludes that there would be no impacts on climate change beyond the impacts discussed in the 2023 LR GEIS and in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 of the proposed rule (88 FR 13329). Based on this information, the NRC staff concludes that GHG impacts on climate change for Turkey Point SLR would be SMALL.

## E.10 Climate Change Impacts on Environmental Resources

With respect to climate change, the draft rule proposes to amend Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 by adding the new Category 2 issue “Climate change impacts on environmental resources.” This new issue considers the additive effects of climate change on environmental resources that may also be directly affected by continued operations and refurbishment during the LR term. The effects of climate change can vary regionally and climate change information at the regional and local scale is necessary to assess trends and the impacts on the human environment for a specific location. The impacts of climate change on environmental resources during the LR term are location-specific and cannot be evaluated generically.

The issue of climate change impacts was not identified as either a generic or plant-specific issue in the 1996 LR GEIS or the 2013 LR GEIS. However, the 2013 LR GEIS described the environmental impacts that could occur on resources areas (land use, air quality, water resources, etc.) that may also be affected by LR. In site-specific initial LR and SLR environmental reviews prepared since the development of the 2013 LR GEIS, the NRC staff has considered projected differences in climate changes in the United States and climate change

impacts on the resource areas that could be incrementally affected by the proposed action as part of its cumulative impacts analysis. Accordingly, Section 4.15.3.1 of the FSEIS (NRC 2019) discusses the observed changes in climate and the potential future climate change across the Southeast region of the United States during the Turkey Point SLR term, based on climate model simulations under future global GHG emissions scenarios. The NRC staff considered regional projected climate changes from numerous climate assessment reports, including the U.S. Global Change Research Program, the Intergovernmental Panel on Climate Change (IPCC), the EPA, and the NOAA (NOAA 2013, USGCRP 2018). Furthermore, in Section 4.16 of the FSEIS (NRC 2019), the NRC staff evaluated the overlapping impacts from climate change on environmental resources (air quality, water resources, aquatic resources, socioeconomics, historic and cultural resources, and environmental justice), for which the staff found there are incremental impacts due to Turkey Point SLR.

Since the publication of the FSEIS, the IPCC has published a sixth assessment synthesis report and concluded that "[i]t is unequivocal that human influence has warmed the atmosphere, ocean, and land" (IPCC 2023). While the IPCC sixth assessment synthesis report provides recent information regarding climate change, the information does not change the conclusions stated in the FSEIS. In the FSEIS, the NRC staff relied on the best available national climate change studies from the U.S. Global Change Research Program (USGCRP) and the NOAA when discussing and considering climate change projections. There have been no updates to the climate change reports from the USGCRP and the NOAA the since publication of the FSEIS, and the new information published by the IPCC does not alter the conclusions in the FSEIS regarding climate change. Therefore, this issue, "Climate change impacts on environmental resources," has been addressed in the Turkey Point FSEIS (NRC 2019).

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*(See instructions on the reverse)*

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Second Renewal

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Site-Specific Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, NUREG–1437, Supplement 5a, Second Renewal

Draft Report

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10. SUPPLEMENTARY NOTES

Docket Nos. 50-250 and 50-251

11. ABSTRACT (200 words or less)

The U.S. Nuclear Regulatory Commission (NRC) staff prepared this site-specific environmental impact statement (EIS) to supplement the “Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 5, Second Renewal, Regarding Subsequent License Renewal for Turkey Point Nuclear Generating Unit Nos. 3 and 4, Final Report” (NUREG–1437, Supplement 5, Second Renewal) (FSEIS), issued in October 2019. This EIS considers information contained in the Florida Power & Light Company (FPL) June 9, 2022, submittal which supplements its 2018 subsequent license renewal (SLR) application that was considered in the FSEIS. The EIS also considers whether there is significant new information that would change the NRC staff’s conclusions in the FSEIS. Together, this EIS and the previous FSEIS evaluate, on a site-specific basis, all the environmental impacts of continued operation during the SLR term.

Based on the FSEIS and the NRC staff’s evaluation in this EIS, the staff’s preliminary recommendation is that the adverse environmental impacts of SLR for Turkey Point (i.e., the continued operation of Turkey Point for a period of 20 years beyond the expiration dates of the initial renewed licenses) are not so great that preserving the option of SLR for energy-planning decision-makers would be unreasonable.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

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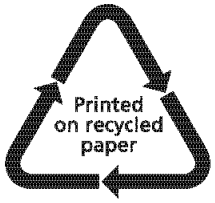


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