

U.S. NUCLEAR REGULATORY COMMISSION



REGULATORY GUIDE 4.2

Supplement 1, Revision 2

Issue Date: August 2024
Technical Lead: J. Davis

PREPARATION OF ENVIRONMENTAL REPORTS FOR NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATIONS

A. INTRODUCTION

Purpose

This regulatory guide (RG) provides guidance to applicants for the format and content of environmental reports (ERs) that are submitted as part of an application for the initial license renewal (LR) or subsequent license renewal (SLR) of a nuclear power plant operating license.

Applicability

This RG applies to applications for the renewal of a nuclear power plant operating license in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants” (Ref. 1), and the associated review under 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions” (Ref. 2). This RG amends Supplement 1, Revision 1, to RG 4.2, “Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications,” issued June 2013.

Applicable Regulations

- The National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code (U.S.C.) 4321 et seq.) (Ref. 3) requires that Federal agencies prepare detailed environmental impact statements (EISs) on proposed major Federal actions significantly affecting the quality of the human environment. A principal objective of NEPA is to require a Federal agency to consider, in its decisionmaking process, the environmental effects (impacts) of each proposed major Federal action and reasonable alternatives. Additional direction is provided in Executive Order 11514, “Protection and Enhancement of Environmental Quality” (Ref. 4), as amended by Executive Order 11991, “Environmental Impact Statements” (Ref. 5), and in the Council on

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Electronic copies of this RG, previous versions of RGs, and other recently issued guides are available through the NRC’s public website in the NRC Library at <https://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/> under Document Collections, in Regulatory Guides. This RG is also available through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML23201A144. The regulatory analysis is associated with a rulemaking and may be found in ADAMS under Accession No. ML24152A224. The associated draft guide DG-4027, may be found in ADAMS under Accession No. ML22165A072, and the staff responses to the public comments on DG-4027, may be found under ADAMS Accession No. ML24086A527.

Environmental Quality's (CEQ's) regulations at 40 CFR Chapter V – Council on Environmental Quality - Parts 1500–1508 (Ref. 6). Regarding the CEQ regulations, as stated in 10 CFR 51.10, the U.S. Nuclear Regulatory Commission (NRC) takes account of those regulations voluntarily, subject to certain conditions.

- 10 CFR Part 51 provides requirements for the NRC's preparation and processing of EIS and related documents under Section 102(2)(C) of NEPA.
- 10 CFR Part 54 provides requirements for the issuance of renewed operating licenses and renewed combined licenses for nuclear power plants licensed pursuant to Sections 103 or 104(b) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2133) (Ref. 7), and Title II of the Energy Reorganization Act of 1974 (42 U.S.C. 5841-5853) (Ref. 8).
 - 10 CFR Part 54.17(c) allows a license renewal application to be submitted within 20 years of license expiration, and NRC regulations at 10 CFR 54.31(b) specify that the renewed license will be for a term of 20 years plus the length of time remaining on the current license. As a result, renewed licenses may be for a term of 20 to 40 years.

Related Guidance

While the guidance provided in the related documents listed below may overlap with guidance in this RG, the purposes of the documents are different. Some of the related documents offer guidance in the development of reference sources that may be useful in the development of an ER, but, unlike this RG, none are specifically intended to offer guidance directly pertinent to preparing the ER itself.

- NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants” (LR GEIS) (Ref. 9), provides the regulatory and technical basis for the findings on environmental issues for initial LR or SLR of nuclear power plants in Table B-1 of NRC regulations in Appendix B to Subpart A of 10 CFR Part 51. The LR GEIS presents the findings of NRC's systematic inquiry into the environmental impacts of continued nuclear power plant operations and refurbishment activities associated with license renewal.
- NUREG-1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants,” Supplement 1, “Operating License Renewal” (Ref. 10), provides the criteria used by the NRC staff in conducting the environmental review and preparing the nuclear power plant-specific supplemental environmental impact statement (SEIS).

Purpose of Regulatory Guides

The NRC issues RGs to describe methods that are acceptable to the staff for implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific issues, and to describe information that the staff needs in its review of applications for permits and licenses. RGs are not substitutes for NRC regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs are acceptable if supported by a basis for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This RG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Parts 51 and 54 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

These information collections were approved by the Office of Management and Budget (OMB), under control numbers 3150-0021 and 3150-0155. Send comments regarding this information collection to the FOIA, Library, and Information Collections Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0021 and 3150-0155), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW, Washington, DC, 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

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ABBREVIATIONS/ACRONYMS

APE	area of potential effects
BTA	best technology available
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act of 1972
EFH	essential fish habitat
EIS	environmental impact statement
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
ER	environmental report
ESA	Endangered Species Act of 1973
GEIS	generic environmental impact statement
GHG	greenhouse gas
gpm	gallon(s) per minute
HAPCs	habitat areas of particular concern
IAEA	International Atomic Energy Agency
IPaC	Information Planning and Consultation
LR	license renewal
L/min	liters per minute
LR GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
MSA	Magnuson-Stevens Fishery Conservation and Management Act of 1996
MTU	metric ton of uranium
MWd	megawatt-days
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
NHPA	National Historic Preservation Act of 1966
NMSA	National Marine Sanctuaries Act
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
RG	regulatory guide
ROW	right-of-way
SAMA	severe accident mitigation alternative
SEIS	supplemental environmental impact statement
SHPO	State Historic Preservation Officer
SLR	subsequent license renewal
THPO	Tribal Historic Preservation Officer
U.S.C.	United States Code

B. DISCUSSION

Reason for Revision

RG 4.2, Supplement 1, Revision 2 updates guidance to align with NRC regulations, changes in environmental statutes and regulations, and Executive Orders since the last revision of the RG. Examples of changes include, but are not limited to, the assessment of continued operations and refurbishment impacts, greenhouse gas (GHG) and climate change, environmental justice, alternatives, cumulative effects, and to fully account for SLR.

Background

Use of this RG will help to ensure the completeness of the information provided in the ER, assist the NRC staff and others in locating important information, and facilitate the environmental review process for license renewals. However, the NRC does not require conformance with this guidance.

This RG also explains how the NRC complies with its environmental protection regulations in 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” for the renewal of nuclear power plant operating licenses. NRC regulations at 10 CFR Part 51 implement Section 102(2) of NEPA. The NRC originally published the license renewal provisions of 10 CFR Part 51 in the *Federal Register* on June 5, 1996 (61 FR 28467) (Ref. 11). The NRC’s intention in developing the 1996 rule was to improve the regulatory efficiency of the environmental review process for the renewal of nuclear power plant operating licenses. Analyses conducted for and reported in NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants,” issued May 1996, support the 1996 rule.

On December 18, 1996 (61 FR 66537) (Ref. 12), the NRC amended the rule to incorporate minor clarifying and conforming changes and to add omitted language. The NRC amended the rule again on September 3, 1999 (64 FR 48496) (Ref. 13), to address the environmental effects of transporting uranium fuel and reactor waste to and from a single nuclear power plant. Analyses conducted for and reported in NUREG-1437, Volume 1, Addendum 1, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Section 6.3—Transportation, Table 9.1 Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report,” issued August 1999, support this amendment. This amendment also addressed local traffic-related transportation impacts from the continued operation of a nuclear power plant during the license renewal term. The NRC amended the rule again on June 20, 2013 (78 FR 37282) (Ref. 14), to redefine the number and scope of the environmental issues that must be addressed during license renewal environmental reviews.

This revision also incorporates lessons learned and knowledge gained from initial LR and SLR environmental reviews conducted in the period leading up to and following completion of the prior update in 2013 and fully considers one term of SLR. Analyses conducted for and reported in NUREG-1437, Revision 2, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants” (LR GEIS), issued in 2024, support this rule amendment.

The LR GEIS evaluated 80 environmental issues and determined that 59 of these issues are adequately addressed for all applicable nuclear power plants. The LR GEIS identifies these as Category 1 issues. The NRC will not require additional analysis in nuclear power plant-specific (hereafter called plant-specific) environmental reviews of Category 1 issues unless new and significant information related to the conclusions in the LR GEIS needs to be considered. Of the remaining 21 issues, 20 are identified as Category 2 issues, which require plant-specific environmental analyses. One environmental issue

(“Electromagnetic fields [EMFs]”) is not categorized. This issue remains uncategorized because there is no scientific consensus on the potential effects from chronic exposure to EMFs.

Applicants for a permit, license, or other authorization to site, construct, and/or operate a new nuclear power plant may use RG 4.2, “Preparation of Environmental Reports for Nuclear Power Stations” (Ref. 15), for developing ERs submitted as part of an application in accordance with 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” and 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants” (Ref. 16).

B.1 Environmental Review Process

After receiving an application for initial LR or SLR that includes the ER, the NRC staff conducts an acceptance review to determine whether the information in the ER is sufficiently complete to begin the environmental (NEPA) review process. After docketing the application, the NRC staff begins the environmental review and starts preparing the plant-specific SEIS to the LR GEIS. NUREG-1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants,” Supplement 1, Revision 2, “Operating License Renewal,” issued in 2024, guides the NRC staff in conducting the environmental review and preparing the SEIS. As part of the review, the NRC staff assesses the environmental impacts of the proposed action (the initial or subsequent renewal of the nuclear power plant’s operating license), no action (not renewing the operating license), and energy replacement alternatives. The SEIS presents conclusions and recommendations concerning the environmental impacts of renewing the nuclear power plant’s operating license. NRC decisionmakers consider these recommendations, together with the findings from the NRC’s safety review (under 10 CFR Part 54), before deciding to either issue or deny the initial LR or SLR operating license.

The NRC’s environmental (NEPA) review process consists of the following actions required by 10 CFR Part 51:

- Publish a notice of intent to conduct an initial LR or SLR environmental review and to prepare a plant-specific SEIS to the LR GEIS in the *Federal Register* (see 10 CFR 51.27, “Notice of Intent”; 10 CFR 51.95(c), “Postconstruction Environmental Impact Statements—Operating License Renewal Stage”; and 10 CFR 51.116, “Notice of Intent”). Send copies of the notice to the appropriate Federal, State, and local agencies and Indian Tribes;¹ public interest groups; and any other persons (e.g., representatives of environmental justice communities²) expressing interest in the initial LR or SLR environmental review. The notice describes the proposed action, explains the NRC’s scoping process, provides information about public meeting locations, states where copies of the ER are available for public examination, and invites members of the public to participate in the scoping process.
- Conduct scoping (see 10 CFR 51.28, “Scoping—Participants”; 10 CFR 51.29, “Scoping—Environmental Impact Statement and Supplement to Environmental Impact Statement”; 10 CFR 51.71, “Draft Environmental Impact Statement—Contents”; and 10 CFR 51.95(c)(1)). The purpose of scoping is to identify environmental issues and invite State and local agency officials; Indian Tribes; representatives of environmental justice communities; environmental interest

1 The term “Indian Tribes” refers to Federally recognized Tribes as acknowledged by the Secretary of the Interior pursuant to the Federally Recognized Indian Tribe List Act of 1994 (25 U.S.C. § 479a) (Ref. 17).

2 Environmental justice communities can also include State-recognized Tribes, those that self-identify as Indian Tribes, and tribal members. Tribal members can be part of an environmental justice community that has different interests and concerns than a Tribal government.

groups; and members of the public to participate in the scoping process. Scoping provides an opportunity for any member of the public to identify environmental issues and concerns they believe are significant that may not have been adequately addressed in the ER. Environmental issues may be introduced in oral statements made at the scoping meeting or in written comments sent directly to the NRC or via www.regulations.gov. During scoping, the NRC staff can visit the nuclear power plant and, if requested, meet with local, regional, and State agencies and Indian Tribes; and representatives of environmental justice communities and environmental interest groups. Depending on issues and concerns raised during scoping, the NRC staff may request additional information from the applicant.

- Prepare a plant-specific draft SEIS to the LR GEIS (see 10 CFR 51.70, “Draft Environmental Impact Statement—General”; 10 CFR 51.71; and 10 CFR 51.95(c)). In developing the draft SEIS, the NRC staff will evaluate (verify and validate) information provided by the applicant and will seek and collect information from independent sources.
- Distribute the draft SEIS for public comment (see 10 CFR 51.73, “Request for Comments on Draft Environmental Impact Statement,” and 10 CFR 51.74, “Distribution of Draft Environmental Impact Statement and Supplement to Draft Environmental Impact Statement; News Releases”). The U.S. Environmental Protection Agency (EPA) and the NRC will publish separate notices of availability in the *Federal Register*. Copies of the draft SEIS will be distributed to appropriate Federal, State, and local agencies and Indian Tribes; environmental justice communities; environmental interest groups, organizations, and individuals who expressed interest and participated in the environmental review; and any other individuals who request a copy.
- Prepare the final SEIS to the LR GEIS (see 10 CFR 51.90, “Final Environmental Impact Statement—General”; 10 CFR 51.91, “Final Environmental Impact Statement—Contents”; and 10 CFR 51.95(c)). In developing the final SEIS, the NRC staff will respond to all comments and revise the SEIS, if necessary. After addressing public comments, the NRC staff will determine whether the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. The NRC staff will then submit the final SEIS to the EPA, and both agencies will publish notices of availability in the *Federal Register* (see 10 CFR 51.93, “Distribution of Final Environmental Impact Statement and Supplement to Final Environmental Impact Statement; News Releases,” and 10 CFR 51.118, “Final Environmental Impact Statement—Notice of Availability”). Copies of the final SEIS will be distributed to Federal, State, and local agencies and Indian Tribe environmental justice communities; environmental interest groups, organizations, and individuals who expressed interest and participated in the environmental review; and any other individuals who request a copy.
- The Commission may hold a hearing if it determines that it is in the public interest or if a request for hearing and petition to intervene is granted. In accordance with 10 CFR 2.105(a)(10), “Notice of Proposed Action” (Ref. 18), the NRC will issue a notice of opportunity for hearing as soon as practicable. Any person whose interest may be affected by the initial LR or SLR action may request a hearing. (See also 10 CFR 51.104, “NRC Proceeding Using Public Hearings; Consideration of Environmental Impact Statement.”)
- Prepare a record of decision (see 10 CFR 51.103, “Record of Decision—General”). The record of decision will summarize the impacts of initial LR or SLR and the energy replacement alternatives considered in the SEIS, the measures taken to minimize and/or reduce any adverse environmental effects, and any license conditions adopted in connection with mitigation measures. In making a final decision on initial LR or SLR, the NRC will determine whether the adverse environmental

impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. The NRC will publish the Commission's final decision on whether to renew the nuclear plant operating license in the *Federal Register*.

B.2 Consideration of International Standards

The International Atomic Energy Agency (IAEA) works with member states and other partners to promote the safe, secure, and peaceful use of nuclear technologies. The IAEA develops Safety Requirements and Safety Guides for protecting people and the environment from harmful effects of ionizing radiation. This system of safety fundamentals, safety requirements, safety guides, and other relevant reports, reflects an international perspective on what constitutes a high level of safety. To inform development of this RG, the NRC considered the Commission's International Policy Statement (Ref. 19) and Management Directive and Handbook 6.6, "Regulatory Guides" (Ref. 20), which states that consensus standards, industry guidance documents, and international standards are endorsed in RGs, as appropriate. The staff did not identify any IAEA Requirements or Guides with information applicable to this RG.

C. STAFF REGULATORY GUIDANCE

C.1 Environmental Reports—General Guidance

The applicant should provide sufficient information to support the environmental impact assessments in the ER and the basis for each finding (conclusion). Though other documents (e.g., previous ER(s) or safety analysis reports) may be incorporated by reference, the applicant should summarize the information from these documents used in impact assessments. The applicant must also ensure the ER provides all the relevant information and analyses called for in NRC regulations, 10 CFR 51.45, “Environmental Report,” and 10 CFR 51.53(c), “Postconstruction Environmental Reports—Operating License Renewal Stage.” The ER should describe in detail the affected environment around the nuclear power plant, modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities.

Treatment of Category 1 Issues

According to 10 CFR 51.53(c)(3)(i), “The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part.” However, the ER should describe the affected environment and any environmental resources pertinent to those Category 1 issues that apply to the nuclear power plant and identify Category 1 issues that do not apply. The ER should also discuss any new and significant information related to Category 1 environmental issues (see “New and Significant Information” paragraph below). The applicant can incorporate the findings in the LR GEIS into the ER for applicable Category 1 issues.

Treatment of Category 2 Issues

According to 10 CFR 51.53(c)(3)(ii), “The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part.” This RG describes acceptable methods for fulfilling this requirement.

New and Significant Information

According to 10 CFR 51.53(c)(3)(iv), “The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.” New and significant information is (1) information that identifies a significant environmental issue that was not considered or addressed in the LR GEIS and, consequently, not codified in Table B-1, “Summary of Findings on Environmental Issues for Initial and One Term of Subsequent License Renewal of Nuclear Power Plants,” in Appendix B, “Environmental Effect of Renewing the Operating License of a Nuclear Power Plant,” to Subpart A, “National Environmental Policy Act—Regulations Implementing Section 102(2),” of 10 CFR Part 51, or (2) information not considered in the assessment of impacts evaluated in the LR GEIS leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.³ Further, a significant environmental issue includes, but is not limited to, any new activity or aspect associated with the nuclear power plant that can act upon the affected environment in a

³ For example, *Union Electric Company d/b/a Ameren Missouri*, (Callaway Plant, Unit 2) CLI-11-5, 74 NRC 141, 167-68 (2011). (Ref. 21)

manner or an intensity not previously recognized or quantified. An applicant should state in the ER whether it is aware of any new and significant information and describe any actions taken to identify new information and evaluate its significance. This information will assist the NRC in fulfilling its responsibilities under 10 CFR 51.70(b), which states, in part, “The NRC staff will independently evaluate and be responsible for the reliability of all information used in the draft environmental impact statement.” Other interested parties, as well as the NRC, may also identify new and significant information during scoping and public comment periods. Chapter 5 of this RG provides guidance on actions that an applicant may take to identify and evaluate new and significant information.

Impact Findings

For Category 2 issues and for new and significant information, applicants should assess the environmental impact in proportion to their significance as prescribed in the CEQ’s terminology including revisions in Part 1501—NEPA and Agency Planning (40 CFR Part 1501) and Part 1508—Definitions (40 CFR 1508). CEQ requires examination of both the context of an action and the intensity of the effects in making a significance determination as to the adverse effect of the proposed action. In determining whether the incremental environmental effects (impacts) of the proposed action (license renewal—either initial LR or SLR) are significant, license renewal applicants should consider the action in several contexts. The analysis of context should consider the characteristics of the geographic area and its resources, such as proximity to unique or sensitive resources or communities with environmental justice concerns. For nuclear power plant-specific environmental issues, significance depends on the effects in the relevant geographic area, including, but not limited to, consideration of short- and long-term effects, as well as beneficial and adverse effects. The analysis of the intensity of effects should consider the degree to which the action, as applicable, may (1) adversely affect public health and safety; (2) adversely affect unique characteristics of the geographic area such as historic or cultural resources, parks, Tribal sacred sites, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas; (3) violate relevant Federal, State, Tribal, or local laws or other requirements or be inconsistent with Federal, State, Tribal, or local policies designed for the protection of the environment; (4) have potential effects on the human environment that are highly uncertain; (5) adversely affect resources listed or eligible for listing in the National Register of Historic Places; (6) adversely affect an endangered or threatened species or its habitat, including habitat that has been determined to be critical under the Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.) (Ref. 22); (7) adversely affect communities with environmental justice concerns; and (8) adversely affect rights of Tribal Nations that have been reserved through treaties, statutes, or Executive Orders (40 CFR 1501.3(d)).

In assessing the significance of environmental impacts, the applicant should conform to the following terminology and definitions used by the NRC in the LR GEIS and codified in footnotes to Table B-1 in Appendix B to Subpart A of 10 CFR Part 51:

- **SMALL** – For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission’s regulations are small.
- **MODERATE** – For the issue, environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **LARGE** – For the issue, environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

In assessing environmental impacts on federally protected ecological resources and historic and cultural resources that require interagency consultation with Federal agencies or Indian Tribes, the applicant should report findings in accordance with the terminology used in the relevant statutes and their implementing regulations.

For federally listed and proposed species protected under the ESA, the applicant should report findings as:

- “may affect and is likely to adversely affect”
- “may affect but is not likely to adversely affect”
- “no effect”

For federally designated and proposed critical habitat protected under the ESA, the applicant should report findings as:

- “is likely to destroy or adversely modify”
- “is not likely to destroy or adversely modify”
- “no effect”

For essential fish habitat (EFH) protected under the Magnuson-Stevens Fishery Conservation and Management Act of 1996 (MSA) (16 U.S.C. 1801 et seq.) (Ref. 23), the applicant should report findings as:

- “substantial adverse effects”
- “more than minimal but less than substantial adverse effects”
- “no adverse effects”

For sanctuary resources protected under the National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 et seq.) (Ref. 24), the applicant should report findings as:

- “may affect and is likely to destroy, cause the loss of, or injure”
- “may affect but is not likely to destroy, cause the loss of, or injure”
- “no effect”

These findings are further explained in Section 4.6.4 and summarized in Table 4-1, Table 4-2, and Table 4-3 of this RG. Notably, individual findings should be made for each federally protected ecological resource. Thus, the number of findings for a given license renewal will depend on the number of federally protected species and habitats present in the affected area.

For impacts to historic properties assessed under Section 106 of the National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. 300101 et seq.) (Ref. 25), the assessment should lead to one of three conclusions for NHPA (see 36 CFR 800.4) (Ref. 26):

- No historic properties present, the undertaking will have no effect to historic properties
- Historic properties present, the undertaking will have no adverse effect upon them
- Historic properties present, the undertaking will have an adverse effect upon one or more historic properties (see 36 CFR 800.5)

Mitigation of Adverse Effects

In 10 CFR 51.45(c), the NRC requires the consideration of alternatives available for reducing or avoiding any adverse effects. In addition, applicants should identify any ongoing mitigation and discuss the potential need for additional mitigation. Mitigation alternatives should be considered in proportion to the significance of the impact. In 40 CFR 1508.1(y), “Mitigation.” CEQ identifies five types of mitigative actions:

1. Avoiding the adverse effect altogether by not taking a certain action or parts of an action.
2. Minimizing the adverse effect by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the adverse effect by repairing, rehabilitating, or restoring the affected environment.
4. Reducing or eliminating the adverse effect over time by preservation and maintenance operations during the life of the action.
5. Compensating for the adverse effect by replacing or providing substitute resources or environments.

The applicant should identify all relevant, reasonable mitigation measures that could reduce or avoid adverse effects, even if they are outside the jurisdiction of the NRC.

Direct, Indirect, and Cumulative Effects

Environmental effects or impacts include direct, indirect, and cumulative effects.

The environmental impact assessment should consider and discuss each type of these effects in relation to the impact attributed to license renewal (see “Impact Findings” above). The CEQ regulations at 40 CFR Part 1508.1, “Definitions,” define three types of effects.

As defined in 40 CFR 1508.1(i)(1)–(4), “Effects or impacts” means changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and include the following:

- Direct effects, which are caused by the action and occur at the same time and place.
- Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects

and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

- Cumulative effects, which are effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from actions with individually minor but collectively significant effects taking place over a period of time.
- Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, such as disproportionate and adverse effects on communities with environmental justice concerns, whether direct, indirect, or cumulative. Effects also include effects on Tribal resources and climate change-related effects, including the contribution of a proposed action and its alternatives to climate change, and the reasonably foreseeable effects of climate change on the proposed action and its alternatives. Effects may also include those resulting from actions which may have both beneficial and adverse effects, even if on balance the agency believes that the effects will be beneficial.

Chapter 1 Purpose of and Need for Action

This chapter of the ER should briefly describe the purpose of and need for the proposed action.

The applicant's ER should include the following statement:

The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decisionmakers, such as State, utility, and, where authorized, Federal agencies (other than the NRC). Unless there are findings in the safety review required by the Atomic Energy Act or the NEPA environmental review that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions about whether a particular nuclear power plant should continue to operate.

Chapter 2 Proposed Action and Description of Alternatives

This chapter of the ER should briefly describe the proposed action, the nuclear power plant, and energy replacement alternatives. The applicant should also describe any proposed refurbishment activities, programs, and activities for managing the effects of aging during the license renewal term (initial LR or SLR).

2.1 The Proposed Action

The proposed action is the renewal of the nuclear power plant operating license, leading to continued reactor operations and maintenance activities during the renewal term (initial LR or SLR). These activities may include refurbishment for extended nuclear plant operation and changes to surveillance, monitoring, inspections, testing, trending, and recordkeeping (i.e., SMITTR). The applicant may undertake refurbishment and surveillance, monitoring, inspections, testing, trending, and recordkeeping activities because of findings from the 10 CFR Part 54 aging management review or for other reasons, such as opportunities for improved economic operation and maintenance during the license

renewal term. This section of the ER should describe only those license renewal activities that can affect the environment. The level of detail should be sufficient to support the impact assessments in the ER. For reference, Chapter 2 of the LR GEIS describes reactor operations and refurbishment activities associated with license renewal.

As described in 10 CFR 51.53(c)(2), the ER, in part, must contain the following:

[A] description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21 of this chapter. This report must describe in detail the affected environment around the plant, the modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities. In addition, the applicant shall discuss in this report the environmental impacts of alternatives and any other matters discussed in § 51.45.

2.2 General Plant Information

The applicant should briefly describe in the ER the major features of the nuclear power plant and the reactor operation, inspection, maintenance, and refueling activities and practices that would occur during the license renewal term (initial LR or SLR). Information presented should describe the following systems.

Reactor and Containment Systems

This section of the ER should briefly describe the nuclear power plant, including the reactor, reactor core power, fuel, percent uranium-235 enrichment, irradiation level, refueling cycle, containment system, design net electrical output, and the vendor of the nuclear steam supply system.

Cooling and Auxiliary Water Systems

This section of the ER should describe the cooling and auxiliary water systems in the order that water flows through them, including approach, intake structure, trash racks, screens (including mesh sizes), screen wash, and fish return or collection systems. It should also provide appropriate figures or maps to illustrate the system pathway. This description should include the rates of average, seasonal, and maximum water withdrawal, estimated consumptive water use, the flow rates or volume of the water body from which cooling water is withdrawn, the location of water withdrawal, and intake velocity at the screens for the last 5 years. The applicant should describe in detail any structural or operational measures, such as the schedule of traveling screen operation or planned outages, used to reduce impingement of fish and shellfish. This description should include a typical water balance or budget showing rates of water withdrawal, losses to evaporative cooling (e.g., for cooling towers), blowdown, contributions from other comingled effluents, and other such inputs or outputs. The applicant should also describe typical temperature changes as water passes through the system, as well as temperatures at the outfall, the size of the plume and mixing zone, and National Pollutant Discharge Elimination System (NPDES) or other permit conditions related to temperature. The ER should include copies of such permits and supporting documentation in an appendix. This section should also describe chemical additions or other measures used to clean or maintain condensers and other components. The sections of the ER concerning surface water, impingement mortality and entrainment, and effects of thermal effluents on aquatic organisms should refer to this section when appropriate to avoid unnecessary repetition. For plants with once-through cooling systems and cooling ponds, this section should provide sufficient detail about the cooling system to support the analysis of the impacts of impingement mortality, entrainment, and thermal effluents on aquatic organisms.

Radioactive Waste Management

Each nuclear power plant has a radioactive waste system to collect, treat, and dispose of radioactive and potentially radioactive wastes that are byproducts of reactor operations. Radioactive wastes are classified as either liquid, gaseous, or solid.

The applicant should provide a brief plant-specific description of the major features of the liquid, gaseous, and solid radioactive waste management systems. The information should include a description of the systems and types of waste treatment used (e.g., filtration, demineralizers, dewatering, and resin filtration for liquid wastes), onsite storage facilities, and any offsite waste treatment and transportation and disposal of the waste.

Nonradioactive Waste Management

Each nuclear power plant has a nonradioactive waste system to collect, treat, and dispose of nonradioactive wastes that are byproducts of plant operations. The EPA, in accordance with the Resource Conservation and Recovery Act (42 U.S.C. 82) (Ref. 27), classifies certain nonradioactive hazardous wastes as hazardous based on characteristics including ignitability, corrosivity, reactivity, and toxicity. State regulators may add other wastes to the EPA list of hazardous wastes.

The applicant should provide a brief plant-specific description of the major features of the nonradioactive waste storage and disposal programs. The information should include details on the types of waste, handling, storage, and disposal. This section of the ER should also provide information on State permits or any other special permits for the generation, handling, storage, and disposal of nonradiological waste. This section should also describe pollution prevention and waste minimization programs being used at the plant site.

Power Transmission Systems

The applicant should list and describe in-scope transmission lines, including the length or distance of lines; the width of right-of-ways (ROWs); ROW maintenance plans, procedures, or protocols; and the pesticides and herbicides used in ROWs, including information on how and when they are released. The applicant should also describe the protocol for applying chemicals near streams and wetlands and any procedures in place to protect historic properties and cultural resources. In addition, the applicant should provide a map of all in-scope transmission lines and ROWs. Only those transmission lines that connect the plant to the switchyard where electricity is fed into the regional power distribution system (encompassing those lines that connect the plant to the first substation of the regional electric power grid) and power lines that feed the plant from the grid during outages are considered within the scope of the environmental review.

2.3 Refurbishment Activities

Describe any refurbishment activities performed in support of or otherwise associated with, or necessary for, license renewal (initial LR or SLR). The applicant should identify major facility modifications at the nuclear power plant, including structures and components (e.g., steam generators, vessel heads) that will be replaced or modified. The section should describe where equipment, material, and components will be stored on the plant site before installation, as well as their removal and ultimate disposal. The location and nature of environmental impacts if refurbishment activities will directly or indirectly affect the environment should also be discussed.

The applicant should describe any activities required to support the transport and delivery of equipment, material, and components, such as dredging or bridge and road modifications. Project plans and an implementation schedule should also be discussed, along with a brief explanation of how refurbishment activities will be integrated with refueling and maintenance outages and/or other activities. It should also list any Federal, State, and local permits needed for the refurbishment and their status.

The environmental effects of refurbishment activities described in this section should be discussed in Chapter 4 of the ER.

2.4 Programs and Activities for Managing the Effects of Aging

Applicants should characterize any changes to power plant operations, inspections, maintenance activities, systems, and administrative control procedures during the renewal term designed to manage the effects of aging (as required by 10 CFR Part 54) that could impact the environment. Environmental impacts different from those described in the final environmental statement for the current operating license should be described in detail.

2.5 Employment

The applicant should provide the most current estimate of total annual permanent, full-time, onsite employment (i.e., the total estimated number of full-time employees) and their place of residence by county, city, or town. The average number of refueling outage workers, duration of refueling outages (number of weeks), and their frequency (number of months) should also be provided.

The ER should also present the estimated number of workers required to support any refurbishment activities. The amount of time (days or months) as well as an estimate of peak employment should be provided.

Applicants should also note in the ER any anticipated changes in the size of the onsite workforce arising from changes in surveillance, monitoring, inspections, testing, trending, and recordkeeping activities during the license renewal term. The applicant should also estimate changes in indirect employment resulting from changes in the onsite workforce. Employment multipliers used and their source, along with any additional information needed for the NRC to verify the appropriateness of the multipliers, should be provided. Using an estimate of average household size for the region, the applicant should estimate the change in total population associated with license renewal.

2.6 Alternatives to the Proposed Action

In addition to considering the environmental effects, or impacts, of the proposed action (license renewal), the NRC must also consider the environmental effects of alternatives to replace or offset the generating capacity of the nuclear power plant or to mitigate potential adverse impacts. The NRC considers the environmental effects of license renewal according to 10 CFR 51.103(a)(5), which states the following:

In making a final decision on a license renewal action pursuant to Part 54 of this chapter, the Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

This section should briefly describe the process the applicant used to identify replacement energy alternatives. Guidance on the treatment of reasonable alternatives to the proposed action are discussed in

greater detail in Section 7.1 of this RG. Applicants should briefly describe all the alternative energy sources considered and indicate which replacement energy alternatives are evaluated in detail in the ER.

This section should also include a brief description of alternatives considered that would reduce or avoid adverse effects (e.g., conversion of the cooling system from once-through to closed loop or construction and operation of cooling towers to reduce adverse impacts to aquatic resources). Guidance in Section 7.2 of this RG describes the treatment of these alternatives in greater detail.

Chapter 3 Affected Environment

Information that NRC reviewers need to describe the plant's environmental setting is discussed in this chapter. Applicants should include the following information about the affected environment to assist the NRC staff in its review of potential environmental impacts during the license renewal term (initial LR or SLR):

- Describe the location of the nuclear power plant, including the State, county, town, township, service districts, and parish boundaries, as appropriate. Provide maps showing the boundaries of political jurisdictions.
- Include a map, or maps, of the nuclear power plant showing site boundaries; the exclusion area; site structures and facilities; major land uses (with land use classification consistent with the U.S. Geological Survey categories given in "USGS NLCD Land Cover Class Legend and Description," updated in 2019 [Ref. 28]); the construction zone for refurbishment, if any; location of any other planned buildings and structures (both temporary and permanent); and transportation routes accessing and adjacent to the nuclear power plant site.
- Provide a map of the 6-mile (10-kilometer) radius of the nuclear power plant site and a 50-mile (80-kilometer) radius, showing county and local municipality boundaries, place names, residential areas, airports, industrial and commercial facilities, roads and highways, railroads, Indian reservation and trust lands, military reservations, and military facilities. Depict features on both the vicinity and regional map(s) as practicable, given varying map scales.
- Identify and describe known and reasonably foreseeable Federal and non-Federal projects and other actions in the vicinity of the nuclear power plant that may contribute to the cumulative environmental effects of license renewal.
- Identify all Federal facilities, including national parks, national forests, national wildlife areas, military facilities, and military reservations; Indian reservation and trust lands; and State parks, recreational areas, and conservation lands. Include distances, as well as any nonattainment and/or maintenance areas defined under the Clean Air Act, as amended, within 50 miles (80 kilometers) of the plant site.
- Provide the projected population within a 50-mile (80-kilometer) radius of the nuclear power plant.

3.1 Land Use and Visual Resources

Land Use

The ER should provide zoning information (e.g., land is zoned for industrial and/or commercial use), including acreage and percentage of land use and land cover by category within the nuclear power

plant site boundary and/or property. Onsite land use or land cover can be divided into four basic categories: (1) developable unused open portions of the site, including fields and forest uplands; (2) nondevelopable wetlands and open waterbodies (i.e., marshes, bogs, swamps, streams, ponds, estuaries, and rivers); (3) developed portions of the site, including facilities, structures, parking, landscaped areas, leased lands, and visitor and recreation areas; and (4) the total amount of land disturbed during the construction and operation of the nuclear power plant. The applicant should provide a map of the 6-mile (10-kilometer) radius of the nuclear power plant showing major land uses and land cover with land use classifications consistent with the U.S. Geological Survey categories. The applicant should also provide information about local county comprehensive land use, zoning, and development plans describing anticipated population and housing growth, control measures, and changing land use patterns.

Section 307(c)(3)(A) of the Coastal Zone Management Act of 1972 (16 U.S.C. 1456 et seq.) (Ref. 29) requires applicants for Federal licenses or permits to certify that the proposed activity in a coastal zone or coastal watershed boundary, as defined by each State participating in the National Coastal Zone Management Program, is consistent with the enforceable policies of that State's Coastal Zone Management Program. States define their coastal zone boundaries by using a variety of parameters, such as the entire State, county or county-equivalent boundaries, political features (e.g., town boundaries), and geographic features (e.g., adjacency to tidal waters). Applicants must coordinate with the State agency that manages the State Coastal Zone Management Program to obtain a determination that the proposed activity would be consistent with their program. A Federal agency cannot issue a license or permit until the State concurs.

For nuclear power plants located in a coastal zone or coastal watershed, as defined by each State participating in the National Coastal Zone Management Program, applicants must submit a consistency certification to the responsible State agency that the proposed license renewal action is consistent with the State Coastal Zone Management Program. Applicants must receive a determination from the State agency that manages the State Coastal Zone Management Program that the proposed license renewal action would be consistent with the State program. Documentation of the State's coastal zone consistency determination for license renewal should be provided in the ER.

Visual Resources

The ER should describe the nuclear power plant's visual setting, including the identity and height of the tallest visible structures and the direction and distances from which these structures are visible, as well as the visibility of lighting and vapor plumes. The applicant should also describe the visual impacts (if they occur) of in-scope transmission lines.

3.2 Meteorology and Air Quality

In this section of the ER, the applicant should provide information that includes a description of the local and regional meteorology and climatology. The applicant should also describe the onsite meteorological monitoring program and data monitoring system, and provide onsite meteorological data measurements (ambient temperature, precipitation, wind speed, and wind direction) for the last 5 years. The applicant should provide a summary of current local air quality with respect to criteria pollutants established under the National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) (Ref. 30) and include a map of the region within a 62-mile (100-kilometer) radius of the site identifying nonattainment and/or maintenance areas (as defined under the Clean Air Act of 1970) (42 U.S.C. 7401 et seq.) (Ref. 31), as amended) and a list of mandatory Class I Federal areas within the same radius. The applicant should identify and describe onsite emission sources; provide site emissions data for all criteria pollutants, volatile organic compounds, and any air toxics (i.e., hazardous air pollutants) that are locally important for the last 5 years; and identify applicable permits.

In addition, if the applicant plans any refurbishment activities (see Section 2.3 of this RG) that would require additional workers, the applicant should also include the following information in the ER to assist the NRC staff in its review of the potential air quality impacts and to facilitate the NRC's conformity analysis in accordance with 40 CFR Part 93, as revised (see 75 FR 17254) (Ref. 32):

- Estimate onsite and offsite vehicle emissions resulting from refurbishment activities, if applicable, that contribute to the pollutants for which the area is in nonattainment or maintenance,⁴ and identify the approximate locations of the emissions during the peak employment period. This estimate may be based on the applicant's estimate of vehicle miles associated with commuting refurbishment workers, other activities directly associated with refurbishment, and emission factors available in the current mobile source models approved by the EPA Office of Transportation and Air Quality.⁵
- If construction equipment (such as cranes, trucks, or earthmoving equipment) is to be used during refurbishment, emissions resulting from use of this equipment should be included for each month that the equipment will be used.⁶
- Estimate fugitive dust emissions generated during ground-disturbing activities.

The applicant should also provide information in the ER regarding air pollutant emission estimates for any new, proposed, modified, or replacement stationary sources, such as backup generators and auxiliary boilers. These estimates should clearly indicate the governing regulations that apply, or are assumed to apply, to the emission sources.

If the nuclear plant uses a cooling tower and is located in a State that regulates particulate emissions from cooling towers, the applicant should conduct an appropriate assessment of such emissions and report the results in the ER.

3.3 Noise

In this section, the applicant should identify the primary onsite noise-generating sources and activities and indicate their distance to the nearest site boundary and nearest noise-sensitive receptor. The applicant should also identify and discuss primary offsite generating sources in the vicinity of the power plant site. If ambient noise studies have been conducted at or near the nuclear plant site, the locations of the measurements and the corresponding noise levels, along with meteorological conditions during the measurement period, should be included. In particular, the applicant should provide information about noise complaints.

4 A good reference for this information is "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors" (historical and current information), which can be found at <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors>.

5 Information on the most current EPA modeling tools for calculating vehicle emissions may be obtained at <https://www.epa.gov/moves>.

6 Emissions for these sources can be calculated using EPA's MOVES model available at <https://www.epa.gov/moves/nonroad-technical-reports>.

3.4 Geologic Environment

Geology

In this section of the ER, the applicant should describe, in general, the site geologic setting, including brief definitions of the rock types present, formation names, and thicknesses. This description should consider geologic conditions or geologic hazards identified since plant construction, such as landslide areas, karst features (e.g., sinkholes), and other conditions that could lead to land subsidence and unstable soils. The seismic history of the site since construction, including the largest historic regional earthquake, should be summarized. The ER should also briefly address any rare or unique geologic resources, including rock, mineral, or energy rights and assets at or adjoining the site.

Soils

In this section of the ER, the applicant should describe, in general, the soils at the plant site, including unconsolidated material that may be naturally occurring or consist of fill, including areas of engineered fill such as those occurring around the nuclear island. The applicant should describe the soils along with their relationship to the site geology (e.g., identify whether fill material was brought in from off site or if onsite excavation material was used). The applicant should identify the erosion potential and suitability and limitation ratings of site soils for current and proposed uses based on current soil mapping and characterization data (see the Natural Resources Conservation Service's "Web Soil Survey") (Ref. 33) and should describe best management practices to control erosion and runoff associated with continued plant operations and refurbishment activities. Any projects undertaken at the plant site to address erosion, subsidence, or sea level rise since the start of plant operations should also be described. This section should also identify any soils that are prime farmland, unique farmland, and other farmland of statewide or local importance on or adjoining the plant site that may be subject to the Farmland Protection Policy Act (7 U.S.C. 4201 et seq.) (Ref. 34).

3.5 Water Resources

Surface Water Resources

In this section of the ER, the applicant should describe the surface water resources at or near the site, as well as the river and stream flow, lake and reservoir volume, water level measurements, intake and discharge (outfall) specifications and operating parameters, and onsite ponds or other impoundments.

The presence of any delineated floodplains or zones of inundation for adjoining and onsite rivers, streams, and other surface water features should be identified on maps in relation to plant infrastructure and briefly described. A brief discussion of the flooding history of the plant site, if any, since plant startup should also be provided. This discussion should also address the plant site's compliance with applicable floodplain regulations. This section should also identify offsite surface water users withdrawing water from the same water body affected by the plant, along with their locations and usage rates (see Section 4.5.1). Appropriate maps of surface water features, intakes, and outfalls should be included.

The applicant should also describe local, State, and Federal permit information for enforcement of water use; water treatment, including biocides and other water system additives and dechlorination systems; NPDES-regulated discharges; storm water runoff controls; and the dredging program history and methods, as applicable. The discussion of surface water resources should include current surface water quality and both ambient conditions and monitoring results from available site studies. Reportable incidents and/or notices of violation received from regulatory

agencies related to surface water resources, including any associated corrective actions taken or mitigation measures implemented by the applicant, should be discussed.

Any applicant for a Federal license or permit to conduct any activity which may result in any discharge into navigable waters is required by Section 401 of the Clean Water Act of 1972, as amended (CWA; 33 U.S.C. 1251 et seq.) (Ref. 35), to provide the Federal licensing agency (in this case, the NRC) with water quality certification from the certifying authority (i.e., State, Tribe, interstate agency, or EPA, as applicable). This certification denotes that discharges from the project or facility to be licensed will comply with CWA requirements and will not cause or contribute to a violation of applicable water quality standards.

In September 2023, EPA published a final rule revising the procedural requirements contained in the 2020 CWA Section 401 Certification Rule at 40 CFR 121 (88 FR 66558) (Ref. 36) (Ref. 37). The final rule became effective on November 27, 2023. To initiate the certification process, Federal license or permit applicants must submit a “request for certification” to the appropriate certifying authority (i.e., State, territory, authorized Tribe, or EPA) (40 CFR 121.5). The revised regulations at 40 CFR 121.6 require, in part, that the certifying authority provide a written confirmation to the project proponent and Federal agency of the date that the request for certification was received. The Federal agency and certifying authority may jointly agree in writing to the “reasonable period of time” for the certifying authority to act on the request for certification, provided the reasonable period of time does not exceed one year from the date that the request for certification was received. The final rule also imposes revised requirements for Federal agencies under the “neighboring jurisdictions process,” specified in 40 CFR Part 121, subpart B. The Federal agency may not issue a license or permit prior to concluding the neighboring jurisdictions process, which includes notifying the EPA regional administrator that the Federal agency has received both the application for the Federal permit or license and either a certification or waiver for a Federal license or permit. However, the certifying authority’s failure or refusal to act on a certification request within the reasonable period of time is considered a waiver, provided the Federal agency promptly notifies the certifying agency and project proponent (applicant), as specified in 40 CFR 121.9.

If the applicant has not received Section 401 certification, the NRC cannot issue a renewed license (initial LR or SLR) unless the certifying authority has otherwise waived the requirement. Documentation of the applicant’s receipt of Section 401 water quality certification for license renewal should be provided in the ER. The NRC also recognizes that some NPDES-delegated States explicitly integrate their CWA Section 401 certification process with NPDES permit issuance under CWA Section 402. In such cases, an applicant should provide a supporting discussion and reference provisions in the nuclear power plant’s current NPDES permit, State statutes, or regulations that convey Section 401 certification.

Groundwater Resources

The ER should describe the site’s groundwater hydrology and identify the hydrostratigraphic units and associated aquifers underlying the site. This discussion should link the previously described site geology with groundwater conditions. The hydrogeologic description should include unit depths and thicknesses, saltwater intrusion, depth to groundwater, groundwater flow directions and rates, and current groundwater quality. Any special designations (e.g., sole source aquifer) should be described. Offsite groundwater users should also be identified along with their locations, usage rates, and aquifers affected (see Section 4.5.2). The applicant should further identify the number and location of onsite water supply wells and monitoring wells on an accompanying map. For onsite supply wells, well capacities and recent usage rates (covering the last 5 years) should be summarized. The applicant should also discuss plant industrial practices involving the use of solvents, hydrocarbons, heavy metals, or other chemicals, and

whether such practices have caused soil or groundwater contamination. This discussion should describe any current contamination and any ongoing corrective action activities. Onsite contaminant sources may include lined or unlined wastewater ponds or lagoons, pipe and valve leakages, fuel spills, or other inadvertent incidents. If no leaks, spills, or accidental releases have occurred that have caused soil or groundwater contamination, the applicant should note that fact. If a plant has current or historical information about soil or groundwater contamination resulting from industrial practices, the applicant should describe the nature and extent of the contamination as compared to applicable soil and/or groundwater quality standards and include the following specific information:

- Provide a list of documented leaks, spills, or accidental releases, including their nature, location, date, and amount spilled and/or released. Include the regulatory agency overseeing the incident and whether a noncompliance or notice of violation was issued. Also, include a site map depicting the locations of the listed incidents and corresponding contamination zones and groundwater plumes.
- Describe the cleanup or other mitigation completed for each of the documented leaks, spills, or accidental releases.
- Provide a summary of existing reports describing site soil and geology, soil and vadose zone contamination, hydrogeologic characterization, and groundwater contamination and remediation.

The applicant should also describe any dewatering systems in operation, including dewatering rates, and include them on a site map, if practicable.

3.6 Ecological Resources

Ecological resources include individuals, species, habitats, and ecosystems and their attributes. The NRC typically addresses ecological resources as three resource groups: terrestrial resources, aquatic resources, and federally protected ecological resources. Wetlands and floodplains, which are transitional areas between terrestrial and aquatic systems, are generally described with terrestrial resources.

Terrestrial Resources

The ER should describe the following attributes of the terrestrial environment.

Ecoregion

Identify the terrestrial ecoregion (Levels I, II, and III) and describe the typical characteristics of the Level III ecoregion (e.g., climate, soils, common plant and animal species, characteristic habitat types).

Site and Vicinity

Identify and describe the terrestrial habitats on and near the site and within ROWs of in-scope transmission lines (e.g., oak-hickory forest, tallgrass prairie, tidal salt marsh, lacustrine wetland). Give special attention to important habitats (e.g., important bird areas, known bat hibernacula, locally significant habitats, natural heritage areas, wildlife sanctuaries and preserves, federally or State-managed lands). Include any wetlands and riparian areas as part of the terrestrial habitat discussion.

Describe any major changes to the terrestrial environment during or after nuclear power plant construction. These may be related to plant construction or operation or the result of other factors.

Note characteristic plant and animal species associated with each habitat type. Give special attention to important species (e.g., keystone species, indicator species, representative species, migratory birds protected under the Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.) (Ref. 38), State-listed species).

Note any non-native, nuisance, and invasive species of local or regional concern, especially those known to be present on the site. Summarize management of such species undertaken at the site, if applicable.

Studies and Monitoring

Describe terrestrial surveys, studies, and monitoring performed on or near the site, including biological entities or ecological attributes chosen for investigation, methodology, results, conclusions, and how conclusions relate to license renewal. Such studies may include wetland surveys, botanical surveys, natural heritage inventories, habitat assessments, or surveys related to State-listed or otherwise sensitive or protected species.

Procedures and Protocols

Describe any site or fleet-wide environmental procedures, wildlife management plans, best management practices, and conservation initiatives undertaken at the site and relevant to terrestrial resources. Relevant procedures and protocol may include landscape maintenance procedures, transmission line ROW maintenance procedures, stormwater management plans, site environmental review procedures that help workers identify and avoid impacts on the ecological environment when performing site activities, and management or conservation plans related to memberships with environmental stewardship councils.

Permits and Regulatory Controls

Describe relevant regional, State, and Federal permits and controls that are in place to reduce or mitigate impacts on the terrestrial environment.

Communications with Federal and State Agencies

Summarize the input of relevant Federal and State agencies with special expertise or jurisdiction over terrestrial resources, as applicable, if the applicant has contacted or coordinated with such agencies during preparation of the ER. Summarize the input of affected Indian Tribes, as applicable. Include copies of correspondence with these agencies in an appendix to the ER.

Figures and Tables

Depict ecological information in maps and figures, as appropriate. Include maps that depict the site and in-scope transmission lines. Land use maps; locations of Federal, State, and local parks and natural areas; significant natural heritage areas; and other ecological information of special interest may be appropriate, as well.

Present data in tables, when applicable. For instance, numerical results of botanical, wetland, and species surveys may be best communicated in tabular form.

Aquatic Resources

The ER should describe the following attributes of the aquatic environment.

Ecoregion

Identify the marine ecoregion (if applicable) and describe typical characteristics of that ecoregion (e.g., predominant oceanographic or topographic features, species composition, and dominant biogeographic forcing agents, such as isolation, upwelling, nutrient inputs, freshwater influx, temperature regimes, ice regimes, exposure, sediments, currents, and bathymetric or coastal complexity).

Site and Vicinity

Identify the waterbodies affected by nuclear power plant operations, including those within ROWs of in-scope transmission lines, and describe the characteristics of the affected waterbodies, including the following:

- the aquatic habitats of the waterbodies
- size, bathymetry, temperature regimes, streamflow and discharge, salinity, tidal flows, typical seasonal fluctuations, sediment types, and general water quality
- main channel, dams, and any flood controls
- additional human uses of the waterbody other than for nuclear power plant cooling (i.e., recreational, industrial, etc.)

Give special attention to important habitats (e.g., spawning and rearing areas, waters within Federal or State parks and preserves).

Identify the relevant watershed(s), including source and receiving waterbodies.

Identify the location of the cooling water intake and discharge structures in river miles, if appropriate. Include the location, in river miles, of nearby dams and flood controls, as applicable.

Describe any major changes to the aquatic environment during or after nuclear power plant construction. These may be related to plant construction or operation or the result of other factors.

Describe the trophic structure and identify important trophic links and potential for trophic cascade.

Note characteristic plant and animal species associated with each affected waterbody. Give special attention to important species (e.g., keystone species, indicator species, representative species, State-listed species, recreational and commercially important fisheries, marine mammals) protected under the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 et seq.) (Ref. 39) and those species vulnerable to impingement and entrainment).

Note any non-native, nuisance, and invasive species of local or regional concern, especially those known to be present on the site. Summarize management of such species undertaken at the site, if applicable.

Studies and Monitoring

Describe aquatic surveys, studies, and monitoring performed on or near the site, including biological entities or ecological attributes chosen for investigation, methodology, results, conclusions, and how conclusions relate to license renewal. Such studies should include baseline monitoring, impingement and entrainment studies, thermal studies, biological characterization studies, and any other studies conducted to support regulatory requirements of CWA Sections 316(a) and 316(b).

Procedures and Protocols

Describe any site or fleet-wide environmental procedures, wildlife management plans, best management practices, and conservation initiatives undertaken at the site and relevant to aquatic resources. Relevant procedures and protocol may include plans related to control of aquatic nuisance species, transmission line ROW maintenance procedures, stormwater management plans, site environmental review procedures that help workers identify and avoid impacts on the ecological environment when performing site activities, and management or conservation plans related to memberships with environmental stewardship councils.

Permits and Regulatory Controls

Describe relevant regional, State, and Federal permits and controls that are in place to reduce or mitigate impacts on the aquatic environment. Describe any conditions of NPDES permits related to impingement, entrainment, or the effects of thermal effluents on the aquatic environment. Include information on CWA Section 404 dredge and fill permits, if applicable. Summarize relevant Federal or State management initiatives, such as fish stocking programs.

Communications with Federal and State Agencies

Summarize the input of relevant Federal and State agencies with special expertise or jurisdiction over aquatic resources, as applicable, if the applicant has contacted or coordinated with such agencies during preparation of the ER. Summarize the input of affected Indian Tribes, as applicable. Include copies of correspondence with these agencies in an appendix to the ER.

Figures and Tables

Depict ecological information in maps and figures, as appropriate. Include maps that depict the affected waterbodies, including any stream or water crossings associated with in-scope transmission lines. Graphic depictions of thermal effluent modeling and maps that show aquatic sampling stations may be appropriate as well.

Present data in tables, when applicable. For instance, numerical results of aquatic monitoring, impingement and entrainment studies, and thermal studies may be best communicated in tabular form.

Federally Protected Ecological Resources

The ER should describe the following attributes of federally protected ecological resources. Such resources include federally listed species and critical habitat protected under the Endangered Species Act (ESA), Essential Fish Habitat (EFH) protected under MSA, and sanctuary resources protected under the NMSA.

Federally Listed Species and Critical Habitat

Define the ESA action area. The action area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02) (Ref. 40). The action area is not limited to the footprint of the action nor is it limited by the Federal action agency's authority; rather, it is a biological determination of the reach of the proposed action on the listed species.

Identify the federally listed species and critical habitats present in the action area. A helpful resource is the U.S. Fish and Wildlife Service's Environmental Conservation Online System Information Planning and Consultation (IPaC) tool (available at <https://ipac.ecosphere.fws.gov/>) (Ref. 41). The IPaC tool allows users to generate official species lists by entering project-specific information. However, the usefulness of this tool directly relates to the accuracy of the information entered into the system. Prior to initiating this step, be familiar enough with the potential effects of license renewal to be able to fully define the action area and to input the action area into IPaC's mapping tool. Notably, while the IPaC tool may contain some species that are jointly under both Services' jurisdiction (e.g., sea turtles), it typically does not include species that are wholly under National Marine Fisheries' jurisdiction (e.g., whales). Information on these species should be sought from other sources.

For each federally listed species potentially present in the action area, describe the taxonomy, physical appearance, distribution and relative abundance, habitat, life history, factors affecting the species' endangered or threatened status, and occurrence of the species within the action area.

For each designated critical habitat present in the action area, describe the characteristics of the physical and biological features of the habitat, designated boundaries, and location in relation to the nuclear power plant site and action area. Include maps, when available.

Include candidate and proposed species and proposed critical habitats, as appropriate.

Essential Fish Habitat

Define the affected area. This step is like determining the ESA action area. Unlike the ESA, however, the MSA and its regulations do not specifically prescribe or define terminology for the affected area. For projects involving both an ESA analysis and EFH analysis, the ESA action area and the EFH affected area are likely similar; both should account for all areas over which direct or indirect impacts to ecological receptors could occur. A primary difference between the two could be that an ESA action area may involve large areas of land that do not apply to the EFH affected area if that land does not contain any aquatic habitat or features.

Identify the EFH present in the affected area and the federally managed species (herein referred to as "EFH species") and life stages to which the EFH applies. A helpful resource is the National Marine Fisheries Service's EFH Mapper tool (available at: <https://www.habitat.noaa.gov/apps/efhmapper/>) (Ref. 42). This tool allows users to view spatial representations of fish species, their life stages, and important habitats. The mapper displays data layers for EFH, habitat areas of particular concern (HAPCs), and EFH areas protected from fishing. It includes links to supporting materials, such as fishery management plans, which contain the official regulatory EFH descriptions.

Describe the distribution, habitat preferences, and diet of each EFH species and life stage.

Describe the physical and biological characteristics of the EFH by species and life stage. Give special attention to HAPCs, when applicable.

Consider prey of EFH species that may be present in the affected area and include these species in the discussion.

Sanctuary Resources

Define the affected area. This step is like determining the ESA action area. Unlike the ESA, however, the NMSA and the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries guidance do not specifically prescribe or define terminology for the affected area. For projects involving an ESA analysis, EFH analysis, and/or an NMSA analysis, the ESA action area, the EFH affected area, and/or the NMSA affected area are likely similar; each should account for all areas over which direct or indirect impacts to ecological receptors could occur. Primary differences could be that an ESA action area may involve large areas of land that do not apply to the NMSA affected area. The EFH affected area could include freshwater bodies or non-marine aquatic habitats or features that do not apply to the NMSA affected area.

Identify the national marine sanctuary present in the affected area. Maps of designated and proposed sanctuaries are available at <https://sanctuaries.noaa.gov/about/maps.html> (Ref. 43). Consider both designated and proposed sanctuaries in the discussion.

Describe the sanctuary resources. Sanctuary resources include any living or nonliving resource of a national marine sanctuary that contributes to the conservation, recreational, ecological, historical, educational, cultural, archaeological, scientific, or aesthetic value of the sanctuary.

Notably, sanctuary resources can include historic resources in addition to ecological resources. Thus, this discussion should be coordinated with the historic and cultural resource analysis if any historic sanctuary resources are present, and the two discussions may be cross-referenced, as appropriate.

Studies and Monitoring

Describe surveys, studies, and monitoring performed on or near the site concerning federally protected ecological resources, if not previously described in the ER. Include biological entities or ecological attributes chosen for investigation, methodology, results, and conclusions.

Procedures and Protocols

Describe any site- or fleet-wide environmental procedures, wildlife management plans, best management practices, and conservation initiatives undertaken at the site and relevant to federally protected ecological resources, if not previously described in the ER.

Permits and Regulatory Controls

Describe relevant regional, State, and Federal permits and controls that are in place to reduce or mitigate impacts on federally protected ecological resources, if not previously described in the ER.

Communications with Federal and State Agencies

Summarize the input of relevant Federal and State agencies with special expertise or jurisdiction over federally protected ecological resources, as applicable. Specifically, this should include the U.S. Fish and Wildlife Service and National Marine Fisheries Service concerning ESA-listed species and critical habitats, National Marine Fisheries Service concerning EFH, and the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries concerning national marine

sanctuaries and their resources. Summarize the input of affected Indian Tribes, as applicable. Include copies of correspondence with these agencies in an appendix to the ER.

Figures and Tables

Depict ecological information in maps and figures, as appropriate. Present data in tables, when applicable.

3.7 Historic and Cultural Resources

Historic and cultural resources are the remains of past human activities and include precontact (i.e., prehistoric) and historic era archaeological sites, districts, buildings, structures, and objects. Historic and cultural resources also include elements of the cultural environment such as landscapes, sacred sites, and other resources that are of religious and cultural importance to Indian Tribes, such as traditional cultural properties that are important to a living community of people for maintaining its culture. Historic and cultural resources are considered to be historically significant if they have been determined eligible for or have been listed on the National Register of Historic Places (NRHP). A historic property is a historic or cultural resource that is eligible for or listed on the NRHP.⁷

NEPA requires Federal agencies to take into account the potential effects of their actions on the cultural environment. The NHPA requires Federal agencies to consider the impacts of their undertakings⁸ on historic properties and consult with the appropriate State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO), or Indian Tribes on a government-to-government basis, and other parties with an interest in the effects of the undertaking, including local governments and the public, as applicable.

The applicant should rely on qualified professionals who meet the Secretary of Interior's standards, 36 CFR Part 61, "Professional Qualification Standards" (Ref. 45), to develop the historic and cultural resource sections in the ER. The applicant should use Section 106 of the NHPA and the implementing regulations at 36 CFR Part 800, "Protection of Historic Properties," as a guide for providing historic and cultural resource information in the ER. An applicant should engage with the SHPO, THPO, Indian Tribes, and interested parties for the purposes of gathering information in developing its ER.⁹ Information gathering by an applicant is not considered consultation pursuant to 36 CFR 800. Consultation with the SHPO, THPO, Indian Tribes, and interested parties is the responsibility of the NRC.

7 As defined in 36 CFR 800.16(l)(1), "*Historic property* means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of Interior. This term includes artifacts, records, and remains that are related to and located within such properties." As defined in 36 CFR 800.16(l)(2), "The term *eligible for inclusion in the National Register* includes both properties formally determined as such in accordance with regulations of the Secretary of the Interior and all other properties that meet National Register listing criteria." National Register criteria for listing are found in 36 CFR Part 60 (Ref. 44), "National Register of Historic Places."

8 As defined in 36 CFR 800.16(y), an undertaking is "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval."

9 Pursuant to 36 CFR 800.2(c)(2)(ii), the NRC is responsible for consulting with Indian Tribes or Native Hawaiian organizations that attach religious and cultural significance to historic properties that may be affected by an undertaking.

The applicant should identify the boundaries of the proposed direct (e.g., physical) and indirect (e.g., visual and auditory) area of potential effects (APE)¹⁰ to be recommended to the NRC. Once the proposed APE has been determined, the applicant should describe historic and cultural resources that have been identified as well as any cultural resources investigations completed within the APE. Applicants should engage the SHPO to determine if further cultural resource investigations are needed to identify historic and cultural resources located within the APE, determine if they are eligible for listing on the NRHP, assess affects, and develop avoidance or mitigation plans to resolve adverse effects. The NRC will use this information to support its NHPA Section 106 consultation and assessment of effects for the proposed project.

Consistent with 36 CFR 800.16(d), the NRC typically defines the license renewal (initial LR or SLR) APE to include lands within the nuclear power plant site boundary and the transmission lines up to the first substation that may be directly (e.g., physically) affected by land-disturbing or other operational activities associated with continued plant operations and maintenance and/or refurbishment activities. The APE may extend beyond the nuclear plant site when these activities may indirectly (e.g., visual and auditory) affect historic properties. This determination is made irrespective of land ownership or control. The applicant should describe the nuclear power plant site and provide the following information in the ER:

- A U.S. Geological Survey quadrangle map that identifies the direct and indirect APEs.
- Identify the APE, as appropriate, for the proposed project area. Note that not all areas of the U.S. (i.e., the original 13 colonies) use the Public Land Survey System (e.g., township, range, and section information).
- Identify any parts of the APE that are Federal, State, or Indian reservation or trust lands.

Cultural Background

This section of the ER should discuss the historic use of the land and the activities that have occurred within the APE and the surrounding area. This includes a description of the cultural history of the region (including the proposed project site) from the beginning of human settlement to the present and a summary of how this information was collected for the proposed APE. Information can be derived from background research (literature review and site file search) and from the use of plat and other historic maps showing ownership, acreage, property boundaries, and the location of existing or former historic structures. Other sources that can assist with description of the cultural background include land records, archival sources, local museums or historical societies, libraries, planning documents, mapping/imaging, and online sources. If available, consult ethnohistoric sources to identify Indian Tribes and other groups that may have historic and cultural ties to the proposed project area. The ER should include, if available, photos of the plant site before construction, preconstruction (showing land clearing), during construction, and postconstruction of the current facility.

Historic and Cultural Resources at the Site and in the Vicinity

This section of the ER should describe historic and cultural resources identified within the direct APE (e.g., including in-scope transmission lines) and indirect APE (e.g., in the vicinity). Applicants

10 As defined in 36 CFR 800.16(d), "Area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking."

should indicate whether a records review for historic and cultural resources was conducted. Historic and cultural resource survey reports specifically prepared for license renewal should be referenced and submitted with the license application or otherwise made available to NRC for review (e.g., via secure online portal). However, information (i.e., reports, maps, and site forms) that discloses the locations of unevaluated, potentially eligible, or eligible historic properties (e.g., archaeological sites) should be withheld from public disclosure. This information may be protected under NHPA Section 304 (54 U.S.C. 100707), especially if there is a risk of harm to the resource. The NRC protects cultural resource information disclosing the location of cultural resources (e.g., maps) under Section 304 of the NHPA, consistent with 10 CFR 2.390(a)(3). Section 304 of NHPA requires the NRC to “withhold from disclosure to the public, information about the location, character, or ownership of a historic resource if the agency and the Secretary of the Interior agree that disclosure may (1) cause a significant invasion of privacy, (2) risk harm to the historic resource, or (3) impede the use of a traditional religious site by practitioners.” Applicants should discuss with the NRC staff during preapplication interactions how to handle sensitive historic and cultural resource information.

The ER should provide the following information:

- description of all past and current historic and cultural resource investigations conducted to identify historic and cultural resources within and surrounding the APE
- documentation of field methods used to identify historic and cultural resources within the APE
- description of all historic and cultural resources, (e.g., precontact and historic archaeological sites, standing structures greater than 50 years in age or of historical significance [i.e., the nuclear power plant facility], cemeteries, and traditional cultural properties), and isolated finds and features within the APE
- evaluation of historic and cultural resources for NRHP eligibility (i.e., historic properties) including:
 - a description of the process and methods used to evaluate these resources
 - documentation of SHPO, THPO, and Indian Tribes’ concurrence with process, methods, and conclusions

The applicant is encouraged to engage the NRC staff as early as possible in the planning process, in accordance with 10 CFR 51.40, “Consultation with NRC staff,” to avoid issues related to disclosing sensitive location information related to historic and cultural resources when drafting the ER.

Procedures and Integrated Cultural Resources Management Plans

If historic properties or cultural resources are located within the APEs, the applicant should establish procedures or implement an integrated management plan to protect the historic and cultural resources identified. These plans or procedures are not required to be included in the ER; however, the ER should acknowledge if they exist or are being drafted, as applicable.

NHPA Section 106 Consultation

Consultation in support of NHPA Section 106 is the responsibility of the Federal agency, and the NRC is required to take the lead on consulting with the SHPO, THPO, Indian Tribes (on a government-to-government basis), and interested parties as outlined in 36 CFR 800; consultation is not

the responsibility of the applicant.¹¹ The applicant should engage with these parties to gather sufficient information pertinent to the NHPA Section 106 review process in order to assist the NRC in the timely completion of its NHPA Section 106 compliance requirements. The ER should contain a summary of the applicant's initial outreach efforts to date, including the process used to identify Indian Tribes and potential interested parties that may have a demonstrated interest in the proposed project. The applicant should evaluate the significance of the historic and cultural resources and assess any effects the proposed project may have on them. For areas not surveyed (e.g., areas too disturbed or devoid of potential historic and cultural resources), proper documentation, a basis for exclusion, and concurrence on survey methodology from the SHPO should be provided.

The ER should contain copies of all correspondence with the SHPO, THPO, Indian Tribes, and other interested parties (e.g., local governments, historical societies, members of the public) with whom the applicant engaged to gather information about historic and cultural resources within the APE. These documents should be included in an appendix of the ER. The applicant should provide the information and analysis needed for the NRC to comply with Section 106 requirements in a manner that minimizes the potential for delays in the environmental review.

3.8 Socioeconomics

The ER should include the following information to assist NRC staff in its review of the potential socioeconomic impacts during the license renewal term (initial LR or SLR):

- Based on information provided in Section 2.5, provide current employee residential distribution information in a table showing the annual average number of nuclear power plant workers by county and community. Also indicate where refueling and maintenance outage workers generally stay. Identify commuter routes for the workers and traffic conditions on local roads.
- Describe public recreational facilities and tourist attractions located in the vicinity of the nuclear power plant, including projected use if available.
- Provide a table showing the distribution of property tax payments and discuss other payments, including payments in lieu of taxes to local jurisdictions (e.g., county, municipality, townships, villages, and school districts) for the past 5 years and the associated total revenue or property tax revenue for each jurisdiction and school district.
- Discuss any adjustments to payments caused by reassessments and other actions (including legal actions) that resulted in notable increases or decreases in payments to local jurisdictions.

3.9 Human Health

In this section of the ER, the applicant should summarize information about human health conditions and hazards at the nuclear power plant to assist the NRC staff in its review of potential human health impacts during the license renewal period (initial LR or SLR). This should include a discussion of the plant workforce adherence to safety standards and their use of protective equipment, as required by Federal and State regulations, as it pertains to occupational safety and health hazards at the plant.

¹¹ If an applicant is corresponding with Indian Tribes before the NRC initiates government-to-government consultation, then the applicant should clarify to the Indian Tribes that the NRC will be initiating and conducting government-to-government consultation at a later date for the project. A federally recognized Indian Tribe is not obligated to consult with an applicant or share information about properties of religious and cultural significance with an applicant. A federally recognized Tribe may prefer to communicate directly with NRC at the government-to-government level.

Radiological Hazards

The applicant should describe the general radiological health environment of the nuclear power plant with respect to the following:

- historical data on occupational doses to plant workers
- discussion of any abnormal radionuclide releases, including the types of radionuclides released, calculated doses from the release, monitoring plans to track the release, and any corrective measures performed
- information on potential changes in radiological impacts to the public and workers from continued plant operations during the renewal term
- information on the radiological impacts of any planned refurbishment activities

Microbiological Hazards

Microorganisms that are associated with cooling towers and thermal effluents at nuclear plants that use cooling ponds, lakes, canals or that discharge to publicly accessible surface waters can have negative impacts on human health. Microbiological organisms of concern for public and occupational health, including enteric pathogens (bacteria that typically exist in the intestines of animals and humans [e.g., *Pseudomonas aeruginosa*]), thermophilic fungi, bacteria (e.g., *Legionella* spp. and *Vibrio* spp.), free-living amoebae (e.g., *Naegleria fowleri* and *Acanthamoeba* spp.), as well as organisms that produce toxins that affect human health (e.g., dinoflagellates [*Karenia brevis*] and blue-green algae). Exposure to these microorganisms, or in some cases the endotoxins or exotoxins produced by the organisms, can cause illness or death.

The applicant should consult the State agency responsible for environmental health regarding the potential existence and concentration of the above microorganisms in the receiving waters for plant cooling water discharge to publicly accessible surface waters. The applicant should document the results of this consultation in the ER. The ER should include copies of correspondence with the responsible agency indicating concurrence with the applicant's risk assessment and proposed mitigation strategy, if one is required. The ER should include information on any known upstream heat load contributors to the river and their locations relative to the plant. The ER should also include information regarding any known local, State, or Federal regulations that would govern monitoring requirements and the possible modification of discharge permit limits, if thermophilic microbiological organisms are a concern at the plant's discharge.

Electric Shock Hazards

The ER should describe the in-scope transmission lines and include maps, photographs, or drawings indicating the corridor for these lines. Include a discussion of transmission corridor access and measures taken to meet the National Electric Safety Code (NESC) (Ref. 46), such as clearance standards and 5 mA induced current requirements. The ER should also note any onsite Occupational Safety and Health Administration or industrial safety programs for electrical safety. The applicant should determine whether any locations within the in-scope transmission lines do not meet current NESC standards and indicate these areas on provided maps, photographs, or drawings in the ER. The applicant should also discuss maintenance and associated safety procedures for worker and, if appropriate, public activities near these locations.

Postulated Accidents

The applicant should provide the best available core damage frequency and large early relief frequency values for all hazards and reactor power uprates for comparison to the LR GEIS values. The applicant should also provide summary information regarding any accidents that exceed the design basis with justification for its acceptability during the initial LR or SLR term.

3.10 Environmental Justice

To assist NRC staff in its review of potential human health effects that could occur as a result of license renewal (initial LR or SLR), the applicant should describe the general demographic composition of minority populations, low-income populations and communities (by race and ethnicity), and Indian Tribes in the vicinity of the nuclear power plant that could be affected by continued reactor operations and refurbishment activities. The geographic scale should be commensurate with the impact area to facilitate the evaluation of potentially affected environmental justice communities and neighborhoods that may be disproportionately affected. The ER should also include information about migrant workers and provide geographic information about the location of these populations and communities. Migrant workers are those who move from one location to another in response to various employment opportunities associated with seasonal farming, construction, and manufacturing.

3.11 Waste Management

The ER should describe the nuclear plant's radioactive and nonradioactive waste management systems and programs. Some of this information can be incorporated by reference from the ER discussion developed in response to Section 2.2 of this RG. The ER should include the following information:

- a description of the radioactive and nonradioactive waste management systems designed to collect, store, and dispose of all wastes generated and effluent control systems, including the systems and controls used for liquid, gaseous, and solid wastes, or alternatively, citations showing where such information would be available in the final safety analysis report or other documents submitted to the NRC
- pollution prevention and waste minimization measures in place or planned to reduce or eliminate the quantities of gaseous and liquid emissions to the environment and the quantities of wastes shipped offsite for processing or disposal
- descriptions, names, and locations of facilities currently used and likely to be used in the future for offsite processing and disposal of wastes
- information on current disposal activities including size and location of disposal sites as well as the plans for ultimate treatment and/or restoration of retired disposal sites
- identification of radiation sources stored onsite as solid waste (e.g., contaminated equipment, low-level radioactive waste storage, storage of used steam generators)
- independent spent fuel storage
- description of all sources, types, quantities, and composition of solid, hazardous, radioactive, and mixed wastes expected from the proposed action

- anticipated disposal plans for all wastes (i.e., transfer to an offsite waste disposal facility, treatment facility, or storage onsite)
- description of waste management cumulative impacts

3.12 Greenhouse Gas Emissions and Climate Change

In this section of the ER, the applicant should discuss and identify direct and indirect GHG emission sources (e.g., stationary combustion sources, mobile sources, refrigeration systems, electrical transmission and distribution systems) at the site. This discussion should quantify GHG emissions from these sources in carbon dioxide equivalents for at least the last 5 years. If the applicant plans any refurbishment activities, the applicant should also include GHG emissions resulting from refurbishment, including an estimate of GHG emissions from additional worker vehicles and construction equipment.

This section of the ER should also describe any observed regional changes in key climate change indicators (e.g., precipitation, temperature, storm frequency and severity, sea level rise, floods, and droughts) from climate assessment reports (e.g., U.S. Global Change Research Program, Intergovernmental Panel on Climate Change) and onsite and vicinity monitoring (e.g., trends in site meteorological data, temperatures of surface water resources that are affected by the plant).

Chapter 4 Environmental Consequences of the Proposed Action and Mitigating Actions

General Guidance

As previously discussed, the LR GEIS evaluates 80 environmental issues, and analyses have determined that 59 of these issues, identified as Category 1 issues in the LR GEIS, are adequately addressed for all applicable nuclear plants. The NRC will not require additional analysis in plant-specific environmental reviews unless new and significant information is identified. Chapter 5 of this RG, which addresses preparation of Chapter 5 of the ER, discusses ways to identify new and significant information. The applicant may adopt the findings in the LR GEIS for Category 1 issues if no new and significant information is discovered.

Of the remaining 21 NEPA issues, 20 are identified as Category 2 issues, which require plant-specific environmental analysis. The following sections discuss information that the applicant should include in the ER to assist the NRC staff in evaluating the impacts of these 20 Category 2 issues. One issue (“Electromagnetic fields [EMFs]”) is not categorized at this time. The issue of EMFs remains uncategorized because there is no scientific consensus on the potential impacts from exposure to EMFs. The NRC staff discusses this situation in the LR GEIS and in nuclear power plant-specific (hereafter called plant-specific) supplements to the LR GEIS.

The presentation of Category 2 issues in this section follows the format of Table B-1 for each Category 2 issue in Appendix B to Subpart A of 10 CFR Part 51. This discussion also references the specific requirements stated in 10 CFR 51.53(c)(3)(ii). The steps for reviewing each Category 2 issue include: (1) determine whether the NEPA issue is applicable to the environmental review of this nuclear plant using the criteria given in 10 CFR 51.53(c)(3)(ii)(A) through (Q); (2) if not applicable, briefly explain in the ER why it is not applicable; and (3) if the issue is applicable, provide the information and assessment specified in the appropriate section below. The assessment and other information should be sufficient to determine the extent of the environmental effects and the significance of the impact as defined in the “Impact Findings” section located in Section C.1 of this RG.

The applicant should assess direct, indirect, and cumulative effects or impacts. Section C.1 of this RG defines these effects.

The applicant should also consider mitigation measures to reduce or avoid adverse effects where applicable. The applicant should identify and discuss possible mitigation measures in proportion to the significance of the adverse impact. If there is no adverse impact to be mitigated, the applicant should present the basis for that determination. For those mitigation measures discussed in the ER, the applicant should describe the benefits and costs of each measure. Section C.1 of this RG defines mitigation measures.

The applicant should include map information as appropriate in the ER for issues addressed in Chapter 4. This section should also present any new and significant information in sufficient detail and depth to support an impact assessment. Text, tables, and graphic information should support the assessment of impacts presented in Chapter 4 of the ER.

4.1 Land Use and Visual Resources

Land use and aesthetic impacts are evaluated in the LR GEIS and are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, land use and aesthetic impacts do not need to be analyzed.

4.2 Air Quality

Air quality impacts are evaluated in the LR GEIS and are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, air quality impacts do not need to be analyzed.

4.3 Noise

Noise impacts are evaluated in the LR GEIS and are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, noise impacts do not need to be analyzed.

4.4 Geology and Soils

Geology and soils impacts and related geologic conditions and the effects on the associated resources (e.g., rock and mineral resources) are evaluated in the LR GEIS and are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, where applicable; otherwise, geology and soils impacts do not need to be analyzed.

4.5 Water Resources

The following water resources-related Category 2 issues require a plant-specific assessment.

4.5.1 Surface Water Resources

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

This section applies to nuclear power plants with cooling ponds or cooling towers using makeup water from a river.

Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 (referred to throughout this section as Table B-1) states the following:

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

Specifically, 10 CFR 51.53(c)(3)(ii)(A) requires, in part, the following:

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

Section 4.5.1.1.9 of the LR GEIS discusses surface water use conflicts. Additional surface water conflict information is needed only for plants withdrawing makeup water from a river. If the plant meets this condition, the applicant should provide the information and analysis described below.

Information and Analysis Content

If the plant obtains its water from a river as defined above and uses cooling towers or cooling ponds, the applicant should include the following information in the ER:

- Provide estimates of the quantities and timing of cooling water withdrawals and discharges. Estimate current consumptive water use and future consumptive water use during the license renewal period. Provide water level, flow, and stream gauge data so that water balance calculations can be verified.
- Compare the consumptive water use by the heat dissipation system to flows in the source water body (i.e., the river from which water is withdrawn for cooling tower or cooling pond makeup water). Base this comparison on records of the current license period. Project and compare consumptive use and stream flows during the license renewal period.
- Estimate the quantities of other ongoing water withdrawals and consumptive water uses in the portion of the water body affected by the plant and indicate whether these withdrawals or uses are expected to change during the license renewal period.
- Describe mitigation measures (e.g., limiting withdrawals during droughts) that have been used to reduce the adverse impacts on river flow of consumptive water use and the mitigation measures that are expected to be used during the license renewal period. Briefly explain the rationale for rejecting measures that were considered but not implemented.

4.5.2 Groundwater Resources

Groundwater Use Conflicts (Plants That Withdraw More Than 100 Gallons per Minute [gpm])

This section applies to plants using more than an annual average of 100 gallons per minute (gpm) (378 liters per minute [L/min]) of groundwater.

Table B-1 states the following:

Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.

Specifically, 10 CFR 51.53(c)(3)(ii)(C) requires the following:

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

Section 4.5.1.2.3 of the LR GEIS discusses this issue. If the applicant can provide withdrawal records or other evidence that the plant does not pump more than an annual average of 100 gpm (378 L/min) of groundwater, the applicant should note this fact in the ER and need not provide additional information.

Information and Analysis Content

If the plant pumps more than an annual average of 100 gpm (378 L/min), the applicant should provide the following information and analyses to enable the NRC staff to assess the magnitude and significance of potential groundwater use conflicts during operation:

- Describe all groundwater aquifers potentially impacted by the operation of the licensee's onsite wells and wells that may be on adjacent property that support nuclear power plant operations, including approximate areal extent, thickness, porosities, and hydraulic conductivities of aquifer strata. Discuss significant uncertainties, anisotropies, and inhomogeneities.
- Describe existing and known future offsite and onsite wells, including average flow rate, peak flow rate, water use, and completion depth.
- Include maps of steady-state piezometric surfaces estimated with onsite and offsite wells at peak pumpage, average pumpage, and no pumpage. These maps should indicate the location of all wells and should annotate each offsite well with the drawdown of the piezometric surface attributable to both the onsite and offsite wells.
- Describe the methods of analysis, including the assumptions used.
- Describe existing and known future water rights (including Tribal water rights).
- Describe any wetlands in the vicinity that might be impacted by a lowered water table.
- Evaluate the significance of the present and future effects of onsite withdrawal on offsite wells. Additionally, describe any potential mitigation measures and state whether they will be or have been implemented.

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

This section applies to plants using cooling towers or cooling ponds that withdraw makeup water from a river.

Table B-1 states the following:

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

Specifically, 10 CFR 51.53(c)(3)(ii)(A) requires, in part, the following:

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

Section 4.5.1.2.4 of the LR GEIS discusses this issue. Additional groundwater use conflict information is needed only for plants withdrawing makeup water from a river. If the plant meets this condition, the applicant should provide the information and analysis described below.

Information and Analysis Content

If the plant withdraws cooling tower or cooling pond makeup water from a river, the applicant should provide the following information and analyses to enable the NRC staff to assess the groundwater use conflicts during operation:

- Provide a description of alluvial aquifers near the site that could be affected by surface water (see also Section 4.5.1 above) and groundwater withdrawal, including approximate areal extent, thickness, porosities, hydraulic conductivities of aquifer strata, and their interaction with the affected river makeup source as river gage height varies.
- Describe existing and known future offsite and onsite wells, including average flow rate, peak flow rate, water use, and completion depth.
- Include maps of steady-state piezometric surfaces estimated with onsite and offsite wells at peak pumping rates, average pumping rates, and no pumping. These maps should indicate the location of all wells, and each offsite well should be annotated with the drawdown of the piezometric surface attributable to both the onsite and offsite wells. Describe the methods of analysis, including the assumptions used.
- Describe existing and known future water rights (including Tribal water rights).
- Describe any wetlands in the vicinity that might be affected by a lowered water table.
- Evaluate the significance of the present and future effects of onsite withdrawal on offsite wells. Additionally, describe any potential mitigation measures and state whether they will be or have been implemented.

Groundwater Quality Degradation (Plants with Cooling Ponds)

This section applies to plants that have cooling ponds.

Table B-1 states the following:

Sites with cooling ponds could degrade groundwater quality. The significance of the impact 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.

Specifically, 10 CFR 51.53(c)(3)(ii)(D) requires the following:

If the applicant's plant utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.

Section 4.5.1.2.6 of the LR GEIS also discusses this issue.

Information and Analysis Content

If the plant uses cooling ponds, the applicant should provide the following information and analyses to enable the NRC staff to assess the presence and magnitude of groundwater quality degradation during operation:

- Describe cooling pond characteristics (e.g., liners or impermeable materials used, impermeable soils) that would retard or prevent infiltration into local aquifers.
- Identify the types and concentrations of impurities in the cooling pond water and the chemistry of soils along pathways to local aquifers to determine whether cooling pond water can contaminate the groundwater.
- Describe water quality and other characteristics of local aquifers that could be affected by infiltration of cooling pond water.
- Provide Federal, State, and local groundwater quality requirements with emphasis on any changes to these requirements that have occurred during the plant's current license term and any anticipated changes to those requirements during the license renewal term.
- Identify and characterize offsite groundwater users who could be affected by the degradation of aquifers. Include locations and elevations of offsite wells, pumping rates, screened intervals, depth to water, and an estimate of the groundwater needs of local users.
- Describe possible mitigation measures, if they are warranted, and whether they will be or have been implemented.

Radionuclides Released to Groundwater

Table B-1 states the following:

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

Specifically, 10 CFR 51.53(c)(3)(ii)(P) requires the following:

An applicant shall assess the impact of any documented inadvertent releases of radionuclides into groundwater. The applicant shall include in its assessment a description of any groundwater protection program used for the surveillance of piping and components containing radioactive liquids for which a pathway to groundwater may exist. The assessment must also include a description of any

past inadvertent releases and the projected impact to the environment (e.g., aquifers, rivers, lakes, ponds, ocean) during the license renewal term.

Section 4.5.1.2.7 of the LR GEIS discusses this issue.

Information and Analysis Content

Each Nuclear Energy Institute (NEI) member company for their nuclear power plants has committed to following the guidance developed by NEI and contained in NEI 07-07, “Industry Ground Water Protection Initiative—Final Guidance Document,” issued August 2007 and revised in 2019 (Ref. 47). The purpose of the voluntary initiative is to improve a nuclear power plant’s programs for preventing, detecting, and responding to inadvertent releases of radioactive materials that may result in low but detectable levels of plant-related materials in subsurface soils and groundwater. Because each nuclear power plant has developed a site-specific groundwater protection program, the NRC staff must review the implementation of each plant’s program.

For those nuclear power plants that have groundwater monitoring systems composed of wells, the ER should contain the following information, as applicable, with respect to documented inadvertent releases of radionuclides into groundwater (i.e., reports required by 10 CFR 20.2202 (Ref. 48), 10 CFR 20.2203, and 10 CFR 50.72(b)(2)(xi) (Ref. 49), as well as from reports issued in accordance with the reporting criteria contained in NEI 07-07):

- Provide a site map at sufficient scale to show the location of all monitoring wells and water supply wells.
- Include a table depicting well construction information, such as well depth, diameter, screened interval, and construction material.
- Include a table showing depths to water and water-level elevations.
- Provide a groundwater flow direction map for each aquifer or hydrostratigraphic unit beneath the site.
- Develop a table and accompanying map showing the distribution of radionuclide concentrations across the site (e.g., tritium concentrations in picocuries per liter). A series of tables and maps, based on available information, may be necessary to depict the concentration at depth.
- For documented inadvertent releases of radionuclides into groundwater, include a description of any ongoing or completed remediation actions and the residual activity remaining after the remediation was completed, if it is not ongoing.

For those nuclear power plants that rely on a system other than a groundwater monitoring system composed of wells, the applicant should describe the program used for detecting and responding to inadvertent releases of radionuclides into subsurface soils and groundwater.

4.6 Ecological Resources

The following general approach should be used in conducting plant-specific assessments for ecological resources-related Category 2 issues.

4.6.1 General Approach for Information and Analysis Content for All Ecological Issues

The applicant should provide sufficient information in the ER to evaluate how the effects of nuclear power plant operation would affect ecosystem structure and function, alter the stability of plant or animal populations, modify the value or availability of ecosystem services, or noticeably affect other attributes of the ecological environment. Ecosystem services refer to a wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life. For further discussion of these services, see the 1997 article by Daily et al., “[Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems](#)” (Ref. 50).

For all ecological issues, the same general approach can identify the environmental impacts of license renewal and alternatives. This approach generally follows the EPA’s 1998 framework for ecological risk assessment in “[Guidelines for Ecological Risk Assessment](#)” (Ref. 51).

1. Identify Relevant Sources of Information

Identify the relevant sources of information, which may include:

Studies and monitoring. Summarize any surveys, studies, and monitoring that provide site-specific, local, or regional data on ecological resources and that are relevant to assessing the environmental impacts of license renewal and alternatives. Include the biological entities or ecological attributes chosen for investigation, methodology, results, and conclusions.

If data are more than 5 years old, explain whether the studies are relevant in assessing the impacts of license renewal. For example, show that both the potentially affected resources and the effects of the nuclear power plant on those resources have remained, and can be expected to remain, unchanged or similar over the license renewal term.

Communications with and views of relevant regulatory agencies. Document any communications with Federal and State agencies with special expertise or jurisdiction (e.g., EPA or other water quality permitting agencies concerning impingement and entrainment and thermal impacts; U.S. Fish and Wildlife Service and National Marine Fisheries Service concerning federally listed species and critical habitats; State natural resource agencies) that are relevant to assessing impacts and are not documented elsewhere. Include the views of affected Indian Tribes in cases where culturally significant ecological resources may be affected. Discuss major points of view and significant concerns or objections raised by these entities. If relevant communications are documented elsewhere, refer the reader to the appropriate sections. Include other interested stakeholders, as appropriate.

Other sources. Provide in-text citations to other sources of information relied upon and provide full citations in a literature cited section.

2. Identify Potentially Affected Ecological Resources

Identify specific ecological resources and the attributes of those resources potentially at risk. Because ecological systems are complicated, only a subset of resources can be addressed.

Identify the potentially affected ecological resources. Describe the potentially affected resources in terms of ecosystem or habitat type (e.g., oak-hickory forest, tallgrass prairie, tidal salt marsh). Give special attention to important habitats (e.g., important bird areas, known bat hibernacula, spawning and rearing areas, locally significant habitats, natural heritage areas, wildlife sanctuaries and preserves, federally or State-managed lands and waters).

Describe the potentially affected plants and animals in terms of functional groups (e.g., plants, mammals, reptiles, fish, invertebrates) or trophic structure (e.g., producers and consumers). For instance, an aquatic system may include plankton, macrophytes, and periphyton (primary producers); zooplankton and benthic macroinvertebrates (primary consumers); and bottom feeding, planktivorous, and piscivorous fish (secondary and tertiary consumers).

For federally protected ecological resources, identify and describe the potentially affected federally listed species and designated critical habitats protected under the ESA. Include candidate and proposed species and proposed critical habitats, if applicable. Identify and describe EFH, including HAPCs, by federally managed species and life stage, protected under the MSA. Identify and describe any national marine sanctuaries and the living and nonliving resources of those sanctuaries protected under the NMSA.

Identify attributes of those resources potentially at risk. Identify the attributes of the resources of concern that are potentially at risk and that are important to protect (Ref. 51). If adverse effects on a species, habitat, or other ecological resource are possible, the resource should be assessed in terms of spatial scale (e.g., local, regional, or national), temporal scale (e.g., the time frame over which stressors or effects will be evaluated), and resource value (e.g., social, economic, or ecological).

Biodiversity, which refers to the variety of life on Earth at all its levels, including genes, individuals, species, habitats, and ecosystems, is an important attribute to consider. Biodiversity helps maintain the structural diversity and functional integrity of ecosystems and provides a wide pool of biological resources that can respond and adapt to various natural and human-made stressors (Ref. 52).

3. Explain the Relationships between Nuclear Power Plant Operation and Ecological Resource Attributes

Relationships can be examined by identifying the pathways through which potential stressors act on the chosen ecological receptors and expressing these as risk hypotheses (Ref. 50, Section 3.4.1). Risk hypotheses may be very simple, predicting the potential effect of one stressor on one receptor, or extremely complex.

4. Assess and Characterize Potential Impacts

For each potential stressor, multiple ecological receptors may exist, and each receptor may have multiple measurable and susceptible attributes. The effects of nuclear power plant operation on any ecological receptor may be direct or indirect and may vary in spatial or temporal scale. Additionally, the assessment approach may be prospective or retrospective depending on the available data. With such complexity, examining a single line of evidence may not be sufficient to assess a given impact. In such cases, the reviewer should examine several lines of evidence involving several ecological receptors when data allow. If using multiple lines of evidence, explain the qualitative or quantitative method for combining the lines of evidence to arrive at an overall assessment of impact. A typical approach for accomplishing this is to consider weight of evidence (e.g., [Ref. 51], [Ref. 53]).

5. Describe Mitigation Measures

If adverse impacts are identified, describe mitigation measures that have been implemented at the nuclear power plant to reduce such impacts and note whether such measures would continue during the license renewal term. Describe any additional mitigation measures proposed by the applicant or measures that would be required in the future (e.g., conditions anticipated in a future renewed NPDES permit concerning best technology available to minimize impingement mortality and

entrainment). Evaluate the expected effects of the mitigation measures. Briefly explain the rationale for not implementing any measures that were considered but rejected.

6. Describe New and Significant Information

If any new and significant information exists concerning an ecological resource issue, discuss the new information in the impact analysis and explain how it may affect conclusions in the LR GEIS.

4.6.2 Terrestrial Resources

The following ecological resources-related Category 2 issues require a plant-specific assessment.

Non-Cooling System Impacts on Terrestrial Resources

This issue concerns the effects of nuclear power plant operations on terrestrial resources during an initial LR or SLR term that are unrelated to operation of the cooling system. Such activities include landscape and grounds maintenance, stormwater management, elevated noise levels and vibration, and ground-disturbing activities.

Table B-1 states the following:

The magnitude of effects of continued nuclear power plant operation and refurbishment, unrelated to operation of the cooling system, would depend on numerous site-specific factors, including ecological setting, planned activities during the license renewal term, and characteristics of the plants and animals present in the area. Application of best management practices and other conservation initiatives would reduce the potential for impacts.

Specifically, 10 CFR 51.53(c)(3)(ii)(E) requires, in part, the following:

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

Section 4.6.1.1.1 of the LR GEIS discusses non-cooling system impacts on terrestrial resources. This Category 2 issue applies to all nuclear power plants. Each applicant should provide the information and analysis described below.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows.

Describe any known and reasonably foreseeable activities associated with license renewal unrelated to operation of the cooling system that could affect terrestrial resources. Such activities include landscape and grounds maintenance, stormwater management, elevated noise levels and vibration, and ground-disturbing activities. Ground-disturbing activities may be related to refurbishment or other planned activities during the license renewal period that involve demolition or construction.

Describe the following, with a focus on the interfaces with the terrestrial environment and how site procedures, permits, and other controls minimize or mitigate impacts on the terrestrial environment.

- Summarize the site and landscape maintenance activities. Identify site procedures and permits related to the impacts of these activities on terrestrial resources.
- Summarize stormwater management on the site, including any stormwater management plans and NPDES permit conditions related to the impacts of stormwater on terrestrial resources.
- Summarize any elevated noise or vibration levels that would be of particular concern for terrestrial resources, such as those that could disrupt wildlife behavioral patterns or cause animals to avoid certain areas.
- Describe general operations and maintenance activities during the license renewal period that could affect terrestrial resources, such as maintenance or repair of existing buildings, roadways, parking lots, piping, fencing, and security-related structures.
- Describe ground-disturbing activities anticipated during the license renewal period that would disturb terrestrial habitat. Include the amount of land to be disturbed, whether disturbance would be temporary or permanent, the ecological characteristics of the habitat, the species found within the area, and any unique or rare features of the habitat or species found within it. Include terrestrial habitat that would be disturbed by transport or delivery of equipment and supplies as well as laydown or storage of materials, structures, and components. Describe any related road, bridge, rail, or barge slip modifications that would occur that would affect terrestrial habitat.

Discuss relevant regional, State, and Federal permits and controls not already described that would reduce or mitigate non-cooling system impacts on terrestrial resources.

Describe site- or fleet-wide environmental procedures, wildlife management plans, best management practices, and conservation initiatives undertaken or proposed by the applicant that would benefit the terrestrial environment or otherwise mitigate non-cooling system impacts on terrestrial resources.

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

This issue concerns water use conflicts that may arise at nuclear power plants with cooling ponds or cooling towers that use makeup water from a river and how those conflicts could affect terrestrial resources during an initial LR or SLR term.

Table B-1 states the following:

Nuclear power plants could consume water at rates that cause occasional or intermittent water use conflicts with nearby and downstream terrestrial and riparian communities. Such impacts could noticeably affect riparian or wetland species or alter characteristics of the ecological environment during the license renewal term. The one plant where impacts have occurred successfully mitigated the impact. Impacts are expected to be small at most nuclear power plants but could be moderate at some.

Specifically, 10 CFR 51.53(c)(3)(ii)(A) requires, in part, the following:

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water

availability and competing water demands, the flow of the river, and related impacts on...riparian (terrestrial) ecological communities must be provided.

Section 4.6.1.1.6 of the LR GEIS discusses water use conflicts with terrestrial resources. This Category 2 issue applies to nuclear power plants with cooling ponds or cooling towers that withdraw makeup water from a river. Notably, this issue also applies to nuclear power plants with hybrid cooling systems that withdraw makeup water from a river (i.e., once-through cooling systems with helper cooling towers) (e.g., Ref. 54). Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows.

Describe the following, with a focus on the interfaces with the terrestrial environment and how site procedures, permits, and other controls minimize or mitigate impacts on the terrestrial environment. Give special attention to riparian, wetland, and marsh habitats that require regular or periodic surface water flow.

- Summarize the baseline hydrologic regime of the affected surface waters, including seasonal fluctuations in flow, and conditions that could lead to extreme periods of low flow.
- Summarize current and anticipated consumptive water use by the nuclear power plant.
- Identify other users relying on the affected surface waters, including downstream municipal, agricultural, or industrial users, with which the nuclear power plant may compete.
- Identify terrestrial habitats and species that would be especially sensitive to reduced water availability (e.g., riparian, wetland, marsh, and other habitats that require saturation or periodic inundation; amphibians, especially early life stages; wildlife that heavily rely on surface waters, such as beaver [*Castor canadensis*], muskrat [*Ondatra zibethicus*], and wading birds).
- Discuss regional, State, Federal, and Indian Tribes' permits and controls concerning water use and any agreements with water resources control boards.
- Summarize any other current or proposed practices and measures to control or limit operational water use impacts.
- Describe past water use conflicts with terrestrial resources, if any, and evaluate whether such conflicts would be likely to arise again during the license renewal term.

Refer to the ER analysis of water use conflicts with surface water resources, to the extent that it is appropriate, to avoid duplication of information.

4.6.3 Aquatic Resources

The following ecological resources-related Category 2 issues require a plant-specific assessment.

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 an initial LR or SLR term. This includes plants with helper cooling towers that are seasonally operated to reduce thermal load to the receiving waterbody, reduce entrainment during peak spawning periods, or reduce consumptive water use during periods of low river flow.

Table B-1 states the following:

The impacts of impingement mortality and entrainment would generally be small at nuclear power plants with once-through cooling systems or cooling ponds that have implemented best technology requirements for existing facilities under Clean Water Act (CWA) Section 316(b). For all other plants, impacts could be small, moderate, or large depending on characteristics of the cooling water intake system, results of impingement and entrainment studies performed at the plant, trends in local fish and shellfish populations, and implementation of mitigation measures.

Specifically, 10 CFR 51.53(c)(3)(ii)(B) requires, in part, the following:

If the applicant's plant utilizes once-through cooling or cooling pond water intake and discharge systems, the applicant shall provide a copy of current Clean Water Act 316(b) Best Technology Available determinations...or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from impingement mortality and entrainment...

Section 4.6.1.2.1 of the LR GEIS discusses impingement mortality and entrainment of aquatic organisms. This Category 2 issue applies to nuclear power plants with once-through cooling systems or cooling ponds, including plants with hybrid cooling systems (i.e., once-through cooling systems with helper cooling towers). Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows.

Describe impingement and entrainment studies conducted at the nuclear power plant and any supporting studies and data. Include species and taxa chosen for investigation, methodology, results, and conclusions. Provide estimates of the species and number of organisms impinged and entrained on a daily, monthly, and annual basis. Provide estimates of finfish and shellfish mortality associated with impingement. Describe impingement and entrainment losses in terms of lost commercial, recreational, and ecosystem service value. If data are more than 5 years old, explain whether the studies are relevant in assessing the impacts of license renewal. Provide full documentation of analytical or modeling techniques used to assess effects.

Describe baseline studies and other ecological sampling conducted at or near the nuclear power plant conducted to characterize the composition of aquatic populations or monitor their health over time.

Identify temporal and geographical trends in the data that might indicate whether fish and shellfish populations have increased, decreased, or remained stable during nuclear power plant operation. Explain any relationships between patterns of impingement and entrainment at the nuclear power plant and trends in the affected populations.

Summarize the nuclear power plant's current NPDES permit and the status of the permitting authority's best technology available (BTA) determinations.

- If the NPDES permitting authority has made BTA determinations for the nuclear power plant pursuant to CWA Section 316(b) in accordance with the current regulations at 40 CFR Part 122 (Ref. 55) and 40 CFR Part 125 (Ref. 56), which were promulgated in 2014 (79 FR 48300) (Ref. 57), and the plant has implemented any associated requirements or those requirements would be implemented before the license renewal period, no additional analysis is required. In such cases, provide with the ER copies of the NPDES permit, CWA Section 316(b) BTA determinations, studies and information submitted to the NPDES permitting agency pursuant to 40 CFR 122.21(r), and relevant correspondence with the permitting agency. In cases where the NPDES permit has expired but has been administratively continued by the permitting authority because of timely renewal application submission (i.e., at least 180 days before the permit expiration date), provide a copy of the permit renewal application. If certain requirements associated with the CWA 316(b) determination have yet to be implemented, provide a timeline for such implementation.
- If the NPDES permitting authority has not made BTA determinations, analyze the potential impacts of impingement mortality, entrainment, or both using a weight-of-evidence approach. In this approach, consider multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the ER might consider characteristics of the cooling water intake system design, the results of impingement and entrainment studies performed at the facility, and trends in fish and shellfish population abundance indices. The ER should then consider these lines of evidence together to predict the level of impact that the aquatic environment is likely to experience over the course of the license renewal term. In support of this assessment, the applicant should provide with the ER copies of the NPDES permit, NPDES permit renewal application (if applicable), studies and information submitted to the NPDES permitting agency pursuant to 40 CFR 122.21(r), and relevant correspondence with the permitting agency.

The impingement mortality and entrainment analysis should also consider

- location of the cooling water intake structure, intake velocities, and withdrawal volumes
- information on screening device technologies and fish collection and return technologies
- swimming abilities of local species or their surrogates, including burst, prolonged, or sustained speeds
- other relevant life history characteristics of local species, such as size and susceptibility to impingement or entrainment at various life stages; population abundances and distributions; special species statuses and designations; and regional management objectives
- physical or biological factors that might concentrate or attract organisms to the area of the intake

Effects of Thermal Effluents on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

This issue pertains to acute, sublethal, and community-level effects of thermal effluents on finfish and shellfish from operation of nuclear power plants with once-through cooling systems and cooling ponds during an initial LR or SLR term. This includes plants with helper cooling towers that are seasonally operated to reduce thermal load to the receiving waterbody, reduce entrainment during peak spawning periods, or reduce consumptive water use during periods of low river flow.

Table B-1 states the following:

Acute, sublethal, and community-level effects of thermal effluents on aquatic organisms would generally be small at nuclear power plants with once-through cooling systems or cooling ponds that adhere to State water quality criteria or that have and maintain a valid CWA Section 316(a) variance. For all other plants, impacts could be small, moderate, or large depending on site-specific factors, including ecological setting of the plant; characteristics of the cooling system and effluent discharges; and characteristics of the fish, shellfish, and other aquatic organisms present in the area.

Specifically, 10 CFR 51.53(c)(3)(ii)(B) requires, in part, the following:

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

Section 4.6.1.2.4 of the LR GEIS discusses the effects of thermal effluents on aquatic organisms. This Category 2 issue applies to nuclear power plants with once-through cooling systems or cooling ponds, including plants with hybrid cooling systems (i.e., once-through cooling systems with helper cooling towers). Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows.

Describe thermal studies conducted at the nuclear power plant and any supporting studies and data. Include species and taxa chosen for investigation, methodology, results, and conclusions. Provide estimates of the species and number of organisms affected by the thermal effluent on a daily, monthly, and annual basis. Provide areal or volumetric estimates of thermally affected aquatic habitat. Describe effects in terms of lost commercial, recreational, and ecosystem service value. If data are more than five years old, explain whether the studies are relevant in assessing the impacts of license renewal. Provide full documentation of analytical or modeling techniques used to assess effects.

Describe baseline studies and other ecological sampling conducted at or near the nuclear power plant conducted to characterize the composition of aquatic populations or monitor their health over time. Identify temporal and geographical trends in the data that might indicate whether fish and

shellfish populations have increased, decreased, or remained stable during nuclear power plant operation. Explain any relationships between thermal effluent discharges at the nuclear power plant and trends in the affected populations.

Summarize the nuclear power plant's current NPDES permit and the status of the permitting authority's CWA Section 316(a) determination.

- If the NPDES permitting authority has made a determination under CWA Section 316(a) that thermal effluent limits are sufficiently stringent to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water, and the nuclear power plant has implemented any associated requirements, no additional analysis is required. In such cases, provide with the ER copies of the NPDES permit, CWA Section 316(a) determination, CWA Section 316(a) demonstration studies and other information submitted to the NPDES permitting authority pursuant to CWA 316(a), and relevant correspondence with the permitting agency. In cases where the NPDES permit has expired but has been administratively continued by the permitting authority because of timely renewal application submission (i.e., at least 180 days before the permit expiration date), provide a copy of the permit renewal application. If certain requirements associated with the CWA 316(a) determination have yet to be implemented, provide a timeline for such implementation.
- If the NPDES permitting authority has not granted a CWA Section 316(a) variance, analyze the potential impacts of thermal discharges using a weight-of-evidence approach. In this approach, consider multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the ER might consider characteristics of the cooling water discharge system design, the results of thermal studies performed at the facility, and trends in fish and shellfish population abundance indices. The ER should then consider these lines of evidence together to predict the level of impact that the aquatic environment is likely to experience over the course of the license renewal term. In support of this assessment, the applicant should provide with the ER copies of the NPDES permit, NPDES permit renewal application (if applicable), CWA Section 316(a) demonstration studies and other information submitted to the NPDES permitting authority pursuant to CWA 316(a), and relevant correspondence with the permitting agency.

The thermal impact analysis should also consider

- thermal plume characteristics, such as areal extent of the plume and thermal contour maps
- thermal tolerances of local species or their surrogates
- other relevant life history characteristics of local species, such as seasonal absence or presence, population abundances and distributions, special species statuses and designations, and regional management objectives
- data on fish kill events related to nuclear power plant operation
- physical or biological factors that might concentrate or attract organisms to the thermal plume

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

This issue concerns water use conflicts that may arise at nuclear power plants with cooling ponds or cooling towers that use makeup water from a river and how those conflicts could affect aquatic resources during an initial LR or SLR term.

Table B-1 states the following:

Nuclear power plants could consume water at rates that cause occasional or intermittent water use conflicts with nearby and downstream aquatic communities. Such impacts could noticeably affect aquatic plants or animals or alter characteristics of the ecological environment during the license renewal term. The one plant where impacts have occurred successfully mitigated the impact. Impacts are expected to be small at most nuclear power plants but could be moderate at some.

Specifically, 10 CFR 51.53(c)(3)(ii)(A) requires, in part, the following:

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

Section 4.6.1.2.10 of the LR GEIS discusses water use conflicts with aquatic resources. This Category 2 issue applies to nuclear power plants with cooling ponds or cooling towers that withdraw makeup water from a river. Notably, this issue also applies to nuclear power plants with hybrid cooling systems that withdraw makeup water from a river (i.e., once-through cooling systems with helper cooling towers) (e.g., Ref. 54). Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows.

Describe the following, with a focus on the interfaces with the aquatic environment and how site procedures, permits, and other controls minimize or mitigate impacts on the terrestrial environment.

- Summarize the baseline hydrologic regime of the affected surface waters, including seasonal fluctuations in flow, and conditions that could lead to extreme periods of low flow.
- Summarize current and anticipated consumptive water use by the nuclear power plant.
- Identify other users relying on the affected surface waters, including downstream municipal, agricultural, or industrial users, with which the nuclear power plant may compete.
- Identify aquatic habitats and species that would be especially sensitive to reduced water availability (e.g., nearshore habitat, aquatic plants, early life stages of fish and shellfish, species that rely on specific microhabitats that may not be available under low flow conditions).

- Discuss regional, State, Federal, and Indian Tribes' permits and controls concerning water use and any agreements with water resources control boards.
- Summarize any other current or proposed practices and measures to control or limit operational water-use impacts.
- Describe past water use conflicts with aquatic resources, if any, and evaluate whether such conflicts would be likely to arise again during the license renewal term.

Refer to the ER analyses of water use conflicts with surface water resources and terrestrial resources, to the extent that these are appropriate, to avoid duplication of information.

4.6.4 Federally Protected Ecological Resources

The following ecological resources-related Category 2 issues require a plant-specific assessment.

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

This issue concerns the potential effects of continued nuclear power plant operation during an initial LR or SLR term on federally listed species and critical habitats protected under the ESA and under the jurisdiction of the U.S. Fish and Wildlife Service.

Table B-1 states the following:

The potential effects of continued nuclear power plant operation and refurbishment on federally listed species and critical habitats would depend on numerous site-specific factors, including the ecological setting; listed species and critical habitats present in the action area; and plant-specific factors related to operations, including water withdrawal, effluent discharges, and other ground-disturbing activities. Consultation with the U.S. Fish and Wildlife Service under Endangered Species Act Section 7(a)(2) would be required if license renewal may affect listed species or critical habitats under this agency's jurisdiction.

Specifically, 10 CFR 51.53(c)(3)(ii)(E) requires the following:

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license-renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on federally protected ecological resources in accordance with Federal laws protecting such resources, including but not limited to, the Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the National Marine Sanctuaries Act.

Section 4.6.1.3.1 of the LR GEIS discusses federally listed species and critical habitats under U.S. Fish and Wildlife Service jurisdiction. This Category 2 issue applies to all nuclear power plants whose operation may affect federally listed terrestrial and freshwater species or their critical habitat. Listed species under U.S. Fish and Wildlife Service jurisdiction are likely to occur near most operating nuclear power plants. Applicants that meet these conditions should provide

the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows. Notably, in addition to analyzing the impacts of this issue, the ER should contain sufficient information to support the NRC staff's interagency consultation with the U.S. Fish and Wildlife Service.

Analyze the potential effects of license renewal on each federally listed species and designated critical habitat determined in Chapter 3 of this RG to be potentially present in the action area. Consistent with the suggested contents of a biological assessment at 50 CFR 402.12(f), consider including the following information, as applicable:

- the results of site surveys, studies, and inspections of the action area to determine if listed or proposed species are present or occur seasonally
- the views of recognized experts on the species at issue
- a review of pertinent scientific literature and related information
- an analysis of the effects of the action on the species and habitat, including cumulative effects, and the results of any related studies
- an analysis of alternate actions

If formal consultation¹² may be required, provide the following information in accordance with 50 CFR 402.14(c):

- a description of the proposed action and any mitigation measures in sufficient detail to assess the effects of the action on protected species and critical habitat, including the following:
 - the purpose, duration, timing, and location of the action
 - the specific components of the action and how they will be carried out
 - maps, drawings, blueprints, or similar schematics of the action
 - any other available information related to the nature and scope of the proposed action relevant to its effects on protected species or critical habitat
- a map or description of the action area
- available information on the presence, abundance, density, or periodic occurrence of listed species and the condition and location of the species' habitat, including any critical habitat

12 Formal ESA Section 7 consultation is appropriate when a Federal agency determines that an action "may affect and is likely to adversely affect" listed species or critical habitats. For any action in which take of listed species or destruction or adverse modification of critical habitat may occur, formal consultation is required. See Section 4.6.1.3.1 of the LR GEIS and Section 4.10.11 of the ESRP for more information on this topic.

- a description of the effects of the action and an analysis of any cumulative effects
- a summary of any relevant information provided by the applicant or licensee
- any other relevant available information on the effects of the proposed action, including any EISs, EAs, or other relevant reports

Report findings in accordance with terminology used in the ESA and its implementing regulations as identified in Table 4-1. Make individual effect determinations for each listed species and critical habitat; the number of ESA findings for a given license renewal will depend on the number of listed species and critical habitats present in the action area.

Table 4-1. Possible ESA Effect Determinations Made by the Federal Action Agency

Listed Species	Proposed Species	Designated or Proposed Critical Habitat
“may affect and is likely to adversely affect”	“may affect and is likely to adversely affect”	“is likely to destroy or adversely modify”
“may affect but is not likely to adversely affect”	“may affect but is not likely to adversely affect”	“is not likely to destroy or adversely modify”
“no effect”	“no effect”	“no effect”

Applicants are strongly encouraged to coordinate with the U.S. Fish and Wildlife Service on this issue during preparation of the ER, especially for those license renewals that may require formal consultation. Include copies of any relevant correspondence in the ER and give special consideration to the Service’s views when making ESA effect determinations.

Endangered Species Act: Federally Listed Species and Critical Habitats Under National Marine Fisheries Service Jurisdiction

This issue concerns the potential effects of continued nuclear power plant operation during an initial LR or SLR term on federally listed species and critical habitats protected under the ESA and under the jurisdiction of the National Marine Fisheries Service.

Table B-1 states the following:

The potential effects of continued nuclear power plant operation and refurbishment on federally listed species and critical habitats would depend on numerous site-specific factors, including the ecological setting; listed species and critical habitats present in the action area; and plant-specific factors related to operations, including water withdrawal, effluent discharges, and other ground-disturbing activities. Consultation with the National Marine Fisheries Service under Endangered Species Act Section 7(a)(2) would be required if license renewal may affect listed species or critical habitats under this agency's jurisdiction.

Specifically, 10 CFR 51.53(c)(3)(ii)(E) requires the following:

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license-renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on federally protected ecological resources in accordance with Federal laws protecting such resources, including but not limited to, the

Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the National Marine Sanctuaries Act.

Section 4.6.1.3.2 of the LR GEIS discusses federally listed species and critical habitats under National Marine Fisheries Service jurisdiction. This Category 2 issue applies to all nuclear power plants whose operation may affect federally listed marine and anadromous species or their critical habitat. In general, listed species and critical habitats under National Marine Fisheries Service jurisdiction are only of concern at nuclear power plants that withdraw or discharge from estuarine or marine waters. However, anadromous listed species under National Marine Fisheries Service jurisdiction may be seasonally present in the action area of plants located within freshwater reaches of rivers well upstream of the saltwater interface. Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows. Notably, in addition to analyzing the impacts of this issue, the ER should contain sufficient information to support the NRC staff's interagency consultation with the National Marine Fisheries Service.

The recommended content for this issue is identical to the information and analysis content identified above under the issue of "Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife Service Jurisdiction."

Applicants are strongly encouraged to coordinate with the National Marine Fisheries Service on this issue during preparation of the ER, especially for those license renewals that may require formal consultation. Include copies of any relevant correspondence in the ER and give special consideration to the Service's views when making ESA effect determinations.

Magnuson-Stevens Act: Essential Fish Habitat

This issue concerns the potential effects of continued nuclear power plant operation during an initial LR or SLR term on EFH protected under the MSA.

Table B-1 states the following:

The potential effects of continued nuclear power plant operation and refurbishment on essential fish habitat would depend on numerous site-specific factors, including the ecological setting; essential fish habitat present in the area, including habitats of particular concern; and plant-specific factors related to operations, including water withdrawal, effluent discharges, and other activities that may affect aquatic habitats. Consultation with the National Marine Fisheries Service under Magnuson-Stevens Act Section 305(b) would be required if license renewal could result in adverse effects to essential fish habitat.

Specifically, 10 CFR 51.53(c)(3)(ii)(E) requires the following:

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

action on federally protected ecological resources in accordance with Federal laws protecting such resources, including but not limited to, the Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the National Marine Sanctuaries Act.

Section 4.6.1.3.3 of the LR GEIS discusses EFH. This Category 2 issue applies to all nuclear power plants whose operation may affect EFH, including HAPCs. EFH may occur at nuclear power plants located on or near estuaries, coastal inlets and bays, and the ocean. EFH is generally not relevant for license renewal reviews of plants located on rivers well above the saltwater interface or confluence with marine waters; plants located on freshwater lakes, including the Great Lakes; or at plants that draw cooling water from human-made cooling ponds or canals that do not hydrologically connect to natural surface waters. One exception is in cases where a plant draws cooling water from the freshwater portion of a river that is inhabited by diadromous prey of federally managed species (herein referred to as “EFH species”) with designated EFH downstream of the plant. Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows. Notably, in addition to analyzing the impacts of this issue, the ER should contain sufficient information to support the NRC staff’s interagency consultation with the National Marine Fisheries Service.

Analyze the potential effects of license renewal on the EFH by species and life stage determined in Chapter 3 of this RG to be present in the affected area. Consistent with the required contents of an EFH assessment at 50 CFR 600.920(e)(2) (Ref. 58), include the following information:

- a description of the action
- an analysis of the potential adverse effects on EFH and EFH species
- conclusions regarding the effects of the action on EFH
- proposed mitigation, if applicable
- If appropriate, the EFH assessment should also include the following (50 CFR 600.920(e)(4)):
 - the results of site surveys, studies, and inspections that evaluate the habitat and the site-specific effects of the project
 - the views of recognized experts on the habitat or species that may be affected
 - a review of pertinent scientific literature and related information
 - an analysis of alternate actions
 - any other relevant information

Consider prey of EFH species in the analysis. For instance, if a given species with designated EFH downstream of a nuclear power plant consumes diadromous fish that occur upriver of the facility, effects of license renewal on those prey fish would be relevant to the analysis.

Report findings in accordance with terminology used in the MSA and its implementing regulations as identified in Table 4-2. Make individual effect determinations for each EFH species and life stage; the number of EFH findings for a given license renewal will depend on the number of EFH species and life stages with EFH present in the affected area. Importantly, EFH effect determinations characterize the effects on the habitat of the EFH species and their life stages. They do not characterize the effects on the species or the life stages themselves. Similarly, effect determinations for EFH prey characterize the effects on the prey as a food resource rather than the effects on the prey species themselves. For instance, a proposed action that involves water withdrawal from a river for cooling purposes could cause habitat loss (i.e., temporary or permanent physical loss of a portion of the water column). Associated effluent discharge could cause chemical or biological (i.e., temperature and dissolved oxygen content) alterations to the habitat. With respect to prey species, water withdrawals could impinge or entrain prey organisms, which would represent a reduction in available food resources for EFH species within that habitat.

Table 4-2. Possible EFH Effect Determinations Made by the Federal Action Agency

EFH Effect Determinations	Spatial Extent	Duration
“substantial adverse effects” “more than minimal but less than substantial adverse effects” “minimal adverse effects” “no adverse effects”	surface area, depth, and seasonality described in writing with explicit measurements, to the extent possible, or pictorially on a map	temporary v. permanent short-term v. long-term

Give special attention to HAPCs. The Fishery Management Councils and National Marine Fisheries Service identify HAPCs within designated EFH based on the importance of the habitat’s ecological function; the extent to which the habitat is sensitive to human-induced environmental degradation; whether, and to what extent, development activities are, or will be, stressing the habitat type; and the rarity of the habitat type (50 CFR 600.815(a)(8)). If an HAPC is present, make separate effect determinations for the EFH and the HAPC within that EFH. Actions that occur in HAPCs may receive more scrutiny by the National Marine Fisheries Service during EFH consultation when developing conservation recommendations.

Applicants are strongly encouraged to coordinate with the National Marine Fisheries Service on this issue during preparation of the ER, especially for those license renewals that may require EFH consultation. Include copies of any relevant correspondence in the ER and give special consideration to the Service’s views when making EFH effect determinations.

National Marine Sanctuaries Act: Sanctuary Resources

This issue concerns the potential effects of continued nuclear power plant operation during an initial LR or SLR term on sanctuary resources protected under the NMSA.

Table B-1 states the following:

The potential effects of continued nuclear power plant operation and refurbishment on sanctuary resources would depend on numerous site-specific factors, including the ecological setting; national marine sanctuaries present in the area; and plant-specific

factors related to operations, including water withdrawal, effluent discharges, and other activities that may affect aquatic habitats. Consultation with the Office of National Marine Sanctuaries under National Marine Sanctuaries Act Section 304(d) would be required if license renewal could destroy, cause the loss of, or injure sanctuary resources.

Specifically, 10 CFR 51.53(c)(3)(ii)(E) requires the following:

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license-renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on federally protected ecological resources in accordance with Federal laws protecting such resources, including but not limited to, the Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the National Marine Sanctuaries Act.

Section 4.6.1.3.4 of the LR GEIS discusses sanctuary resources. This Category 2 issue applies to all nuclear power plants whose operation may affect the resources of a national marine sanctuary. National marine sanctuaries occur in coastal and marine waters as well as within certain Great Lakes. This issue is generally not relevant for license renewal reviews of plants located on rivers or freshwater lakes or at plants that draw cooling water from human-made cooling ponds or canals that do not hydrologically connect to natural surface waters. Applicants that meet these conditions should provide the information and analysis described below. All other applicants should note in the ER that this issue is not relevant; these applicants need not provide additional information.

Information and Analysis Content

The ER format should follow the general approach described in RG Section 4.6.1 for all ecological resource issues. Specific information and analysis relevant to this issue are as follows. Notably, in addition to analyzing the impacts of this issue, the ER should contain sufficient information to support the NRC staff's interagency consultation with the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries.

Analyze the potential effects of license renewal on sanctuary resources of the national marine sanctuary determined in Chapter 3 of this RG to be potentially present in the affected area. Consistent with the Office of National Marine Sanctuaries' "Overview of Conducting Consultation Pursuant to Section 304(d) of the National Marine Sanctuaries Act" (Ref. 59), consider including the following information, as applicable:

- the purpose or objectives of the proposed action
- the location of the action and any alternative locations
- the methods and means for carrying out the action and any alternative methods available
- the equipment proposed to be used and any alternative equipment
- documentation that supports the determination of the likelihood of the action causing injury to sanctuary resources
- the results of site surveys, studies, and inspections that evaluate the affected area of the project

- the views of recognized experts on the sanctuary resources that may be affected
- a review of pertinent scientific literature and related information
- an analysis of alternate actions considered
- copies of any Federal, territory, State, local, or Indian Tribes’ authorizations, permits, licenses, or other forms of approval (or applications for authorizations, permits, or licenses, if not yet granted) required for the project or a summary of such approvals that have been sought
- copies of pertinent reports, including, but not limited to, any EIS, environmental assessment, or biological assessment prepared, and any other relevant information

Report findings in accordance with terminology used in the NMSA as identified in Table 4-3.

Table 4-3. Possible NMSA Effect Determinations Made by the Federal Action Agency

NMSA Effect Determinations
“may affect and is likely to destroy, cause the loss of, or injure”
“may affect but is not likely to destroy, cause the loss of, or injure”
“no effect”

Notably, sanctuary resources can include historic resources in addition to ecological resources. Thus, this analysis should be coordinated with the historic and cultural resource analysis if any historic sanctuary resources are present, and the two analyses may be cross-referenced, as appropriate.

Applicants are strongly encouraged to coordinate with the Office of National Marine Sanctuaries on this issue during preparation of the ER, especially for those license renewals that may require NMSA consultation. Include copies of any relevant correspondence in the ER and give special consideration to the Service’s views when making sanctuary resource effect determinations.

4.7 Historic and Cultural Resources

The following Category 2 issue requires a plant-specific assessment.

Historic and Cultural Resources

Table B-1 states the following:

Impacts from continued operations and refurbishment on historic and cultural resources located onsite and in the transmission line ROW are analyzed on a plant-specific basis. The NRC will perform a National Historic Preservation Act (NHPA) Section 106 review, in accordance with 36 CFR Part 800 which includes consultation with the State and Tribal Historic Preservation Officer, Indian Tribes, and other interested parties.

Specifically, 10 CFR 51.53(c)(ii)(K) requires the following:

All applicants shall identify any potentially affected historic and cultural resources and historic properties and assess whether continued operations and any planned refurbishment activities would affect these resources in accordance with Section 106 of the National Historic Preservation Act and in the context of the National Environmental Policy Act.

Section 4.7 of the LR GEIS discusses historic and cultural resources. Section 106 of the NHPA requires that Federal agencies consider the effects of the agency's undertaking (including issuance of a license) on historic properties included in, or eligible for, the NRHP and, before approval of an undertaking, give the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. The NHPA defines "undertakings" as any project or activity that is funded or under the direct jurisdiction of a Federal agency, or any project or activity that requires a "Federal permit, license, or approval." The Advisory Council on Historic Preservation's regulations at 36 CFR Part 800, "Protection of Historic Properties," set forth the procedures that define how Federal agencies meet Section 106 responsibilities.

The applicant should provide the information and analysis needed for the NRC to comply with Section 106 requirements in a manner that minimizes the potential for delays in the environmental review. The applicant should identify any activities and impacts associated with continued operations (including maintenance activities) and any refurbishment activities that could affect historic properties within the direct and indirect APE. Applicants should involve and seek input from the SHPO, local historic preservation officials, THPO, Indian Tribes, and interested parties in the assessment and include letters that support these interactions. The applicant should also consider the effects of continued nuclear plant operations and refurbishment activities on historic and cultural resources that do not meet the criteria to be considered a historic property under the NHPA, but could be considered by the SHPO, THPO, Indian Tribes, or local historians to have local historic value and could contribute substantially to an area's sense of historic character.

Information and Analysis Content

The applicant should include the following information in the ER (with appropriate reference to Chapter 3 of the ER to avoid duplication of information):

- Identify any activities associated with continued operations, maintenance, and refurbishment that could affect onsite or offsite historic and cultural resources located within the direct and indirect APEs. Such activities include ground-disturbing activities (e.g., land clearing, grading, excavating, road work), increases in traffic, and noise and visual intrusions.
- Identify and assess effects to historic properties found in the direct and indirect APEs that may be affected by the proposed undertaking (i.e., initial LR or SLR). Use the criteria specified in 36 CFR 800.5 to assess adverse effects on historic properties. Provide a basis and documentation for how a conclusion is reached.
- Identify and assess effects to historic and cultural resources that are not determined to be historic properties but may be considered important in the context of NEPA (e.g., sacred sites, cemeteries, local gathering areas).
- Discuss the direct and indirect effects (e.g., ground disturbance, physical, visual, auditory, atmospheric such as fugitive dust, light, and traffic), if any, from the proposed project, and from any associated transmission lines on nearby historic properties or important historic and cultural resources.

The assessment should lead to one of three conclusions for NHPA (see 36 CFR 800.4):

- No historic properties present, the undertaking will have no effect to historic properties
- Historic properties present, but the undertaking will have no adverse effect upon them

- Historic properties present: the undertaking will have an adverse effect upon them (see 36 CFR 800.5)

If a qualified professional has recommended a “no historic properties present” determination, then the applicant should provide supporting documentation in the ER.

If a qualified professional has recommended a finding of “no adverse effect to historic properties,” the applicant should develop a plan that outlines protective measures to minimize or avoid these effects. The applicant should engage the SHPO, THPO, Indian Tribes, and interested parties in the formalization of these protection plans and document this within the ER.

If a qualified professional determines that adverse effects to historic properties could occur, the applicant should engage with the SHPO, THPO, Indian Tribes, and interested parties and document this determination in the ER. The ER should describe any procedures and cultural resource management plans developed by the applicant to protect historic and cultural resources as well as any measures to avoid, minimize, or mitigate adverse effects. These procedures should also include steps to take in the event of inadvertent discoveries, including the discovery of human remains.

The applicant should be aware that the NRC, as a Federal agency, is responsible for consulting with the SHPO, THPO, Indian Tribes, and interested parties as part of the Section 106 compliance process. If the NRC determines an adverse effect may occur, it will, in accordance with 36 CFR Part 800, develop proposed measures in consultation with identified consulting parties that might avoid, minimize, or mitigate such effects. Such measures, as appropriate, would be discussed in the NRC staff’s SEIS. The applicant will have the responsibility for implementing the measures identified and agreed upon by the consulting parties to avoid, minimize, or mitigate the effects.

For historic or cultural resources that do not meet the criteria to be considered a historic property under the NHPA, the applicant should assess whether there are any potential impacts through the NEPA process as a result of continued operations and provide documentation to support the assessment in the ER.

4.8 Socioeconomics

Socioeconomic impacts are evaluated in the LR GEIS and are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, socioeconomic impacts do not need to be analyzed.

4.9 Human Health

The following human health-related Category 2 issues require a plant-specific assessment.

Microbiological Hazards to the Public

Table B-1 states the following about the public health effects of microbiological (thermophilic) organisms:

These microorganisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, canals, or that discharge to publicly accessible surface waters. Impacts would depend on site-specific characteristics.

Specifically, 10 CFR 51.53(c)(3)(ii)(G) requires the following:

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

Section 4.9.1.1.3 of the LR GEIS discusses this issue. Nuclear plants that use cooling ponds, lakes, canals, or that discharge to publicly accessible surface waters have a potential to enhance the concentration of thermophilic microorganisms. Microbiological organisms of concern for public and occupational health include enteric pathogens (bacteria that typically exist in the intestines of animals and humans [e.g., *Pseudomonas aeruginosa*]), thermophilic fungi, bacteria (e.g., *Legionella* spp. and *Vibrio* spp.), free-living amoebae (e.g., *Naegleria fowleri* and *Acanthamoeba* spp.), as well as organisms that produce toxins that affect human health (e.g., dinoflagellates [*Karenia brevis*] and blue-green algae).

Information and Analysis Content

If the applicant can show that the nuclear plant does not use cooling ponds, lakes, canals and does not discharge to publicly accessible surface waters, the ER should note this fact, and further information or analysis need not be provided. If the plant does use cooling ponds, lakes, canals, or discharges to publicly accessible surface waters, the applicant should provide the following information in the ER:

- If the State advises that tests should be conducted for concentration of *N. fowleri* or other thermophilic microorganisms in the receiving waters, perform the tests when the facility has been operating at a power level typical of the level anticipated during the license renewal period for at least 1 month to ensure a steady-state population during the sampling. Collect samples at locations of potential public use.
- Assess the data collected to determine the magnitude of potential impacts of thermophilic microorganisms on public health during the license renewal term.
- Describe proposed mitigation measures to minimize the exposure to members of the public and the rationale for not implementing any measures that were considered but rejected.

Electric Shock Hazards

Table B-1 states the following:

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

Specifically, 10 CFR 51.53(c)(3)(ii)(H) requires the following:

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

Section 4.9.1.1.5 of the LR GEIS discusses this issue, which concerns only the in-scope transmission lines. Sections 3.1.1 and 3.1.7 of the LR GEIS specifically define which transmission lines are considered in-scope with respect to license renewal environmental reviews. The issue of electric shock potential is reviewed as part of the construction permit. Most transmission lines were designed to comply with the NESC recommendations for electric shock hazard. However, unless the utility has had an active program of transmission line management aimed at reviewing changes in land use in the ROW and the operating characteristics of the transmission line, as well as ensuring compliance with changes in the NESC, the line may not meet current NESC recommendations.

Information and Analysis Content

If the in-scope transmission lines meet current NESC clearance standards, the discussion in the ER should demonstrate that fact. The demonstration should take one of two forms, either (1) a calculation that demonstrates adherence to the current NESC standard and a description of an ongoing program of transmission line ROW supervision and management aimed at ensuring that current electrical shock provisions of the NESC are met, or (2) a transmission line survey. The survey should consider the transmission line characteristics, clearances, and human uses of the transmission corridor and describe measures that could be taken to meet the standards, the measures the applicant plans or proposes to undertake, and whether those measures will meet the standards. It should also consider basic electrical design parameters, including transmission design voltage or voltages, line capacity, conductor type and configuration, spacing between phases, minimum conductor clearances to ground, maximum predicted electrical field strength(s) at 1 meter above ground, the predicted electrical field strength at the edge of the ROW in kilovolts per meter, and the design bases for these values.

Pursuant to 10 CFR 51.53(c)(3)(iii), if any in-scope transmission lines do not meet current NESC clearance standards, the applicant should describe the mitigating alternatives available for reducing any adverse impacts. If applicable, the applicant should explain in detail the rationale for concluding that the standards are not appropriate to the situation (such as other governing standards) or the rationale for not making modifications to meet the standards.

Postulated Accidents

In the June 2013 Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating License, Final Rule (78 FR 37282) (Ref. 60), the Commission reaffirmed that a plant-specific consideration of severe accident mitigation alternatives (SAMAs) will be required at the time of license renewal unless the applicant has previously performed a SAMA analysis for a given nuclear plant. If an applicant has not previously performed a SAMA analysis for their plant, then refer to RG 4.2, Supplement 1, Revision 1 (Ref. 61). In the revised LR GEIS (NUREG-1437, Revision 2), the NRC reviewed postulated accidents including severe accidents and determined they are Category 1. Further information regarding postulated accidents is provided in Chapter 5 of this RG.

4.10 Environmental Justice

The following Category 2 issue requires a plant-specific assessment.

Impacts on Minority Populations, Low-Income Populations, and Indian Tribes

Table B-1 states the following:

Impacts on minority populations, low-income populations, Indian Tribes, and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in nuclear plant-specific reviews.

Specifically, 10 CFR 51.53(c)(3)(ii)(N) requires the following:

Applicants shall provide information on the general demographic composition of minority and low-income populations and communities (by race and ethnicity) and Indian Tribes in the vicinity of the nuclear power plant that could be disproportionately affected by license renewal, including continued reactor operations and refurbishment activities.

Section 4.10 of the LR GEIS discusses environmental justice. Executive Order 12898, “Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations,” issued February 11, 1994 (Ref. 62), directs each Federal agency to “make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” Independent agencies, including the NRC, are not required to follow the terms of Executive Order 12898, but are “requested to comply with the provisions of [the] order.” In a letter to the President, former NRC Chairman Ivan Selin pledged the NRC would “endeavor to carry out the measures set forth in Executive Order 12898 ... as part of NRC’s efforts to comply with NEPA” (Ref. 63).

CEQ has oversight of the Federal government’s compliance with Executive Order 12898 and NEPA. In consultation with EPA, the Environmental Justice Interagency Working Group, and other affected agencies, CEQ developed guidance to further assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed. On December 10, 1997, CEQ issued “Environmental Justice: Guidance under the National Environmental Policy Act” (Ref. 64). CEQ developed this guidance to “further assist Federal agencies with their National Environmental Policy Act (NEPA) procedures.” As a matter of policy, the NRC considers CEQ guidance on environmental justice in its NEPA review process.

CEQ provides the following information on disproportionately high and adverse human health and environmental effects in its guidance:

Disproportionately High and Adverse Human Health Effects – Adverse health effects are measured in terms of the risks and rates of fatal or nonfatal exposure to an environmental hazard and are evaluated as to whether they are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard by a minority population, low-income population, or Indian Tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or exposure rate for the general population or for another appropriate comparison group. The ER should also consider whether health effects occur in a minority population, low-income population, or Indian Tribe affected by cumulative or multiple adverse exposures from environmental hazards.

Disproportionately High and Adverse Environmental Effects – Disproportionately high and adverse environmental effects occur when an impact on the natural or physical environment significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian Tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian Tribes when those impacts are interrelated with impacts on the natural or physical environment; the environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low-income populations, or Indian Tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and the environmental effects occur or would occur in a minority population, low-income population, or Indian Tribe affected by cumulative or multiple adverse exposures from environmental hazards.

In 2004, the Commission issued its “Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions” (69 FR 52040) (Ref. 65), which states, “The Commission is committed to the general goals set forth in E.O. 12898, and strives to meet those goals as part of its NEPA review process.” This policy statement further states that the “NRC’s goal is to identify and adequately weigh or mitigate effects on low-income and minority communities by assessing impacts peculiar to those communities...EJ is a tool, within the normal NEPA context, to identify communities that might otherwise be overlooked and identify impacts due to their uniqueness as part of the NRC’s NEPA review process.” The following guidance is consistent with this policy statement.

The environmental justice review involves identifying minority and low-income populations and Indian Tribes in the vicinity of the nuclear power plant that may be affected by license renewal and any concerns and potential environmental and human health effects that may affect these populations. This includes identifying the geographic areas of comparison (e.g., the percentage of minority and low-income populations and Indian Tribes that geographically reside within affected census block(s) as compared to the average percentage of these populations within a 50-mile [80-kilometer] radius of the site), as well as the significance of any concerns and potential environmental and human health effects and whether these effects would be disproportionately high and adverse when compared to impacts on the general population. The appropriate unit of geographic analysis may be a political jurisdiction, county, region, or State or other similar unit that is chosen so as not to artificially dilute or inflate the affected minority population. If the effects would be disproportionately high and adverse, the review should consider possible mitigation measures to reduce or eliminate these effects. The NRC will perform the environmental justice review to determine whether there would be disproportionately high and adverse human health and environmental effects on minority populations, low-income populations, and Indian Tribes for the plant-specific SEIS. The review will be based on information provided in the ER and scoping.

Information and Analysis Content

The applicant should include the following information in the ER to assist NRC staff in its environmental justice review:

- Based on information about minority and low-income populations, Indian Tribes, and communities residing in the immediate vicinity of the nuclear power plant (as presented in Section 3.10 of this RG that addresses ER Section 3.10), identify any potential human health and environmental concerns these populations and communities may have about continued reactor operations. Also discuss the potential for disproportionately high and adverse human health and environmental effects on these populations and communities.

- To the extent that information is available, describe any observed subsistence consumption behavior patterns—specifically fish and wildlife consumption—by minority and low-income populations and Indian Tribes in the vicinity of the nuclear power plant (see Section 4-4 of Executive Order 12898). This subsistence consumption behavior could consist of hunting, fishing, and trapping of game animals and any other general food-gathering activities (e.g., collecting nuts and berries) conducted by minority and low-income populations and Indian Tribes in the vicinity of the nuclear power plant.
- To the extent that information is available, provide any information about current or past wildlife sampling and testing for radioactivity in game animals such as deer, squirrel, turkey, pheasant, duck, and other game birds and animals that may have been conducted in the vicinity of the nuclear power plant.
- If it is determined that reactor operations and other license renewal-related activities could affect minority and/or low-income populations and Indian Tribes, describe any mitigation measures that have been or could be implemented.

4.11 Waste Management

Impacts associated with waste management activities evaluated in the LR GEIS are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, waste management impacts do not need to be analyzed.

4.12 Greenhouse Gas Emissions and Climate Change

Impacts associated with GHG emissions are evaluated in the LR GEIS and are generic or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, the impact on climate change from the plant's GHG emissions does not need to be analyzed.

The following Category 2 issue requires a plant-specific assessment.

Climate Change Impacts on Environmental Resources

Table B-1 states the following:

Climate change can have additive effects on environmental resource conditions that may also be directly impacted by continued operations and refurbishment during the license renewal 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 license renewal term are location-specific and cannot be evaluated generically.

Specifically, 10 CFR 51.53(c)(3)(ii)(Q) requires the following:

Applicants shall include an assessment of the effects of any observed and projected changes in climate on environmental resource areas that are affected by license renewal.

Section 4.12 of the LR GEIS discusses GHG emissions and climate change impacts.

Information and Analysis Content

The climate change impact analysis should focus on the climate change impacts on those resource areas where there are incremental impacts from continued nuclear power plant operations and any refurbishment activities during the license renewal term. The applicant should include the following information in the ER:

- **Climate change projections:** Future regional climate change projections for the 20-year license renewal term from climate change models, studies, and reports (e.g., U.S. Global Climate Change Research Program). The geographic scope considered for climate change projections should not be greater than the U.S. National Climate Assessment regions (Northeast, Southeast, Midwest, etc.), and when available, local scale projections should be used. Changes in climate parameters (e.g., climate change indicators) should be quantified, including changes in, but not limited to, ambient temperature, precipitation, surface water temperature and levels, length of growing season, and flooding, as appropriate. Climate change projections presented in the ER should specify which future GHG emission scenario(s) were considered.
- **Climate change impacts:** The scope of the climate change impact analysis should focus on those resource areas that could be incrementally affected by the proposed action (license renewal), including consideration of any observed and projected changes in climate on environmental resource areas. The reasonably foreseeable climate change impacts should be discussed in proportion to their significance. The analysis should discuss the impacts and implications from projected climate change parameters on the resource area baseline conditions that were discussed in Chapter 3 of the ER (e.g., elevated water intake temperatures can result in increases in cooling water withdrawals). This establishes the future environmental baseline.
- **Mitigation measures:** Describe mitigation measures, including adaptation and climate change resilience measures, to avoid or minimize adverse climate change impacts on resource areas that are impacted by the proposed action.

4.13 Cumulative Effects

The following Category 2 issue requires a plant-specific assessment.

Cumulative Effects

Table B-1 states the following:

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

Specifically, 10 CFR 51.53(c)(3)(ii)(O) requires the following:

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

Section 4.13 of the LR GEIS discusses cumulative effects. CEQ defines cumulative effects in 40 CFR 1508.1(i)(3) as “effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from actions with individually minor but collectively significant effects taking place over a period of time.” Cumulative effect analyses should consider new and ongoing activities, such as license renewal that are conducted, regulated, or approved by a Federal agency. The goal of the analysis is to introduce environmental considerations into the planning process as early as needed to improve decisionmaking.

The analysis should focus on environmental resources that could be affected by the proposed license renewal action, including continued reactor operations and refurbishment activities. CEQ discusses the assessment of cumulative effects in its 1997 publication “Considering Cumulative Effects Under the National Environmental Policy Act” (Ref. 66). EPA presents useful perspectives on assessing cumulative impacts in EPA 315-R-99-002, “Consideration of Cumulative Impacts in EPA Review of NEPA Documents,” issued May 1999 (Ref. 67).

The cumulative effects analysis in the ER should include the following considerations:

- The geographic region of influence that encompasses the areas of potential environmental effects and the distance at which the environmental effects of the proposed action and past, present, and reasonably foreseeable actions may be experienced. Geographic regions of influence vary by affected resource.
- The timeframe for the cumulative effects analysis incorporates the incremental effects of the proposed action (initial LR or SLR) with past, present, and reasonably foreseeable actions because these combined effects may accumulate or develop over time. Past and present actions include all actions up to and including the date of the license renewal request. The timeframe for the consideration of reasonably foreseeable actions is the 20-year license renewal (initial LR or SLR) term. Reasonably foreseeable actions include current and ongoing planned activities, approved and funded for implementation, or generally have a high probability of being implemented.
- The environmental effects from past and present actions are accounted for in baseline assessments presented in affected environment discussions in Chapter 3 of the ER. Chapter 4 of the ER accounts for the incremental effects or impacts of license renewal.
- The incremental effects of the proposed action (license renewal) when added to the effects from past, present, and reasonably foreseeable actions result in the overall cumulative effect. A qualitative cumulative effects analysis is conducted in instances where the incremental effects of the proposed action (license renewal) and past, present, and reasonably foreseeable actions are uncertain or not well known.
- For some resource areas (e.g., water and aquatic resources), the incremental contributions of ongoing actions within a region are regulated and monitored through a permitting process (e.g., NPDES) under State or Federal authority. In these cases, it may be assumed that cumulative effects are managed as long as these actions (e.g., facility operations) are in compliance with their respective permits.

If, however, the cumulative effects analysis indicates that moderate to large impacts would occur because of license renewal, the ER should identify mitigation measures to reduce and/or avoid any adverse effects. Recent license renewal reviews have found cumulative effects to be small for most environmental resources near a nuclear power plant, with some exceptions.

4.14 Impacts Common to All Alternatives

4.14.1 Uranium Fuel Cycle

Impacts associated with the uranium fuel cycle evaluated in the LR GEIS are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, uranium fuel cycle impacts do not need to be analyzed.

Transportation is a Category 1 issue, and impacts are small as long as nuclear fuel is not enriched beyond 5-percent uranium-235 and the average level of burnup for the peak rod does not exceed 62,000 megawatt-days per metric ton of uranium (MWd/MTU). Applicants that use or plan to seek approval for use of nuclear fuel enriched beyond 5-percent uranium-235 or operate at an average burnup for the peak rod beyond 62,000 MWd/MTU should request early guidance from NRC staff on how to address this issue in the ER.

4.14.2 Termination of Nuclear Power Plant Operations and Decommissioning

Impacts associated with the termination of plant operations and decommissioning are generic (the same or similar at all plants) or Category 1. The applicant should discuss any new and significant information in the ER, if applicable; otherwise, termination of reactor operations and decommissioning impacts do not need to be analyzed.

Chapter 5 Assessment of New and Significant Information

Section C.1 of this RG discusses the regulatory requirement to report new and significant information. While new and significant information can be identified from site visits, environmental audits, and public comments on the draft SEIS, it is also critical for the applicant to identify new and significant information prior to the beginning of the initial LR or SLR environmental review. For each Category 1 issue, the applicant must determine whether any new and significant information exists that would provide a seriously different picture of the environmental consequences of the proposed (license renewal) action than previously considered in the LR GEIS, such as an environmental impact finding different from that codified in Table B-1 (see Section C.1 of this RG for a definition of “new and significant information”) and if so, describe those differences and assess any relevant plant-specific environmental impacts. Applicants should also describe the methods used to identify potential new and significant information. Chapter 5 of the ER should summarize the following information:

- Describe the process for gathering and reviewing new and significant information for the ER. Explain how the process resulted in the identification of any new and significant information for Category 1 issues and any other issues. The explanation should address (1) the process used to identify new information and (2) the process for determining the significance of any new information. The process for identifying new information could include the review of environmental monitoring reports, scientific literature, interviews with environmental and operations staff, discussions with licensees and other peer groups and industry organizations, consultations with experts knowledgeable about the local environment, and consultations with other Federal, State, and local agencies, environmental justice communities, and Indian Tribes, as well as natural resource, permitting, and land use planning agencies. If there is no new and significant information, the applicant should state this determination in the ER.
- Describe any environmental impacts associated with the new and significant information.
- Describe any mitigation measures considered, and implemented, for any adverse impact.

The applicant need not include a detailed description about the discovery of any new and significant information, but such information should be referenced in the ER and made available for review by NRC staff.

If a SAMA review has previously been completed, an applicant must provide an assessment of new and significant information with respect to a prior SAMA analysis. If the probability-weighted consequences of a severe accident have gone down since the applicant's SAMA review (no adverse impact), it is unlikely that any cost beneficial SAMAs would be found. One acceptable method is provided in NEI 17-04, Revision 1, "Model SLR New and Significant Assessment Approach for SAMA," dated August 2019 (Ref. 68). NEI 17-04, Revision 1 is endorsed in this RG for plant-specific environmental reviews.

Chapter 6 Summary of License Renewal Impacts and Mitigating Actions

6.1 License Renewal Impacts

In the ER, the applicant should present a table summarizing the environmental impacts of continued plant operations during the license renewal term (initial LR or SLR). The table should be organized by environmental resource areas in the order of the environmental issues listed in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51.

6.2 Mitigation

The ER should also summarize in tabular form any mitigation measures considered for implementation.

6.3 Unavoidable Adverse Impacts

The ER should summarize "any adverse environmental effects which cannot be avoided should the proposal be implemented," as required by 10 CFR 51.45(b)(2). Chapters 4 and 5 of the ER should identify unavoidable adverse effects, providing a level of detail commensurate with the significance of the effects.

6.4 Irreversible or Irretrievable Resource Commitments

The ER should summarize "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented," as required by 10 CFR 51.45(b)(5). Irreversible and irretrievable commitments of resources include energy, materials, and resources committed and consumed in conjunction with continued nuclear power plant operations and any license renewal-related refurbishment activities and additional waste materials generated. The applicant should briefly describe the magnitude and significance of the resource commitments in the ER. Discussions should be proportionate to the significance of the resource commitments.

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

The ER should summarize "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity," as required by 10 CFR 51.45(b)(4). For operational impacts, "short-term" indicates the operating life of the nuclear power plant (including any extension of reactor operations through license renewal), and "long-term" indicates the period after reactor operations end, continuing as long as the nuclear power plant could have a discernible environmental effect. The term "productivity" should be interpreted broadly to include

both the productivity of resources useful for human activity and the productivity and stability of ecological systems, even those that are not used directly by humans.

Chapter 7 Alternatives to the Proposed Action

Regarding alternatives, 10 CFR 51.45(b)(3) states, in part, the following:

The discussion of alternatives shall be sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102(2)(E)¹³ of NEPA, “appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.” To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form.

In addition, 10 CFR 51.53(c)(2) states, in part, the following:

[T]he applicant shall discuss in this report the environmental impacts of alternatives and any other matters described in § 51.45. The report is not required to include discussion of need for power or economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. The environmental report need not discuss other issues not related to the environmental effects of the proposed action and the alternatives.

The regulation at 10 CFR 51.53(c)(3)(iii) states the following:

The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues in Appendix B to subpart A of this part. No such consideration is required for Category 1 issues in Appendix B to subpart A of this part.

Section 5, “Alternatives including the Proposed Action,” of Appendix A to Subpart A of 10 CFR Part 51 presents requirements for the treatment of alternatives in an EIS. These requirements are consistent with the CEQ regulations implementing NEPA (40 CFR 1502.14), which require that an EIS:

- Rigorously explore and objectively evaluate reasonable alternatives to the proposed action, and, for alternatives that the agency eliminated from detailed study, briefly discuss the reasons for their elimination. The agency need not consider every conceivable alternative to a proposed action; rather, it shall consider a reasonable range of alternatives that will foster informed decisionmaking. Agencies also may include reasonable alternatives not within the jurisdiction of the lead agency.
- Discuss each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.
- Include the no action alternative.

¹³ Changes to the NEPA statute (42 U.S.C. § 4321 et seq.) from the Fiscal Responsibility Act of 2023 (Public Law No. 118-5, 137 Stat. 10) included adding a new Section 102(2)(F) directing agencies to “...study, develop, and describe technically and economically feasible alternatives” (Ref. 69).

- Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.
- Include appropriate mitigation measures not already included in the proposed action or alternatives.
- Identify the environmentally preferable alternative or alternatives amongst the alternatives considered in the environmental impact statement.

Alternatives to the proposed action include the use of other energy sources potentially capable of meeting the purpose and need of the proposed action (initial LR or SLR). A reasonable replacement energy alternative must be commercially viable on a utility scale and operational before the expiration of the reactor's operating license or expected to become commercially viable on a utility scale and operational before the expiration of the reactor's operating license. Reasonable alternatives should also include mitigation measures that would reduce or avoid adverse effects. In deciding whether to renew the operating license, the NRC will consider the environmental impacts of alternatives as well as those of the proposed action. The NRC considers environmental effects of license renewal according to 10 CFR 51.103(a)(5), which states the following:

In making a final decision on a license renewal action pursuant to Part 54 of this chapter, the Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

7.1 Alternative Energy Sources

Alternatives Considered

The purpose and need for the proposed action, as stated in Chapter 1 of the LR GEIS and in Chapter 1 of this RG, is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decisionmakers.

In addition to considering the environmental effects, or impacts, of the proposed action (license renewal), the NRC must also consider the environmental effects of alternatives to replace or offset the generating capacity of the nuclear power plant. Alternatives that meet the purpose and need include (1) replacing existing nuclear generating capacity using other energy sources (i.e., constructing and operating new fossil fuel, nuclear, and renewable energy power plants), and (2) offsetting existing nuclear generation capacity using conservation and energy efficiency (demand-side management), delayed retirement, or purchased power. These alternatives must also be commercially viable on a utility scale and operational before the expiration of the reactor's operating license or expected to become commercially viable on a utility scale and operational before the expiration of the reactor's operating license.

In the ER, the applicant should describe the process used to identify reasonable replacement energy alternatives (see also Section 2.6 of this RG). The applicant should describe each of the replacement energy alternatives selected for detailed analysis. In addition, the applicant should explain why certain alternatives were eliminated from detailed study. The applicant should also indicate which alternatives have been considered by State, utility, or other Federal authorities (e.g., public service commissions; environmental, natural resource, or energy agencies; or other interest groups vested with energy-planning authority, depending on existing energy regulatory structures) and how

these considerations relate to the applicant's selection. This discussion should include State regulations that promote, enhance, prohibit, or challenge alternatives.

Environmental Impacts of Alternative Energy Sources

The ER should describe the environmental impacts of the replacement energy alternatives selected for detailed study in sufficient detail and in similar format to the proposed action so NRC staff can compare the effects of the replacement power alternatives with the effects of continued plant operations. The analyses should address construction and operations impacts (as appropriate) affecting land use and visual resources, air quality and noise, geology and soils, water resources (surface water and groundwater), ecological resources, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management and pollution prevention. The analysis should consider direct and indirect effects and identify unavoidable adverse impacts, irreversible and irretrievable resource commitments, and tradeoffs between short-term use and the long-term productivity of the environment. Each alternative should be analyzed on a site-specific basis. Applicants should consider analyzing the impacts of a replacement energy alternative at either the existing power plant site, at other existing plant or brownfield sites, or on a State- or region-specific basis, depending on the applicant's service area (when applicable) or the power market into which the applicant sells electricity. The applicant should analyze each impact in proportion to its significance. Appendix D of the LR GEIS includes the results of an analysis of the generic environmental impacts of several electricity generating technologies. The applicant may use these results to the extent that they are applicable and brought up to date. Any findings on impact levels for alternatives included in the LR GEIS are intended to illustrate likely impacts and must be revisited on a site- and plant-specific basis in the ER.

7.2 Alternatives for Reducing Adverse Impacts

Alternatives Considered

As noted in 10 CFR 51.53(c)(3)(iii), "The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues in Appendix B to subpart A of this part." Applicants should describe in the ER the process they used to identify and select alternatives for reducing adverse impacts (see also Section 2.6 of this RG). Applicants should describe all the alternatives considered and indicate which alternatives they evaluated in detail.

Typical alternatives considered include closed-cycle cooling or intake modification options for nuclear power plants that currently use once-through cooling.

Environmental Impacts of Alternatives for Reducing Adverse Impacts

The ER should describe the impacts of alternatives for reducing adverse effects in sufficient detail and in similar format to the proposed action so that NRC staff can compare the effects. The analyses should address construction and operations impacts (as appropriate) affecting land use and visual resources, air quality and noise, geology and soils, water resources (surface water and groundwater), ecological resources, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management and pollution prevention. The analysis should consider direct and indirect effects and identify unavoidable adverse impacts, irreversible and irretrievable resource commitments, and tradeoffs between short-term use and the long-term productivity of the environment. Alternatives should be analyzed on a site-specific basis and in proportion to their significance.

7.3 No-Action Alternative

The ER must include an analysis of the no-action alternative. For license renewal (initial LR or SLR), the no-action alternative is a scenario in which the NRC does not renew the applicant's operating license, and the nuclear power plant continues to operate until the expiration of the current license. The applicant/licensee could also decide to terminate reactor operations and begin decommissioning activities prior to license expiration. Decommissioning is not a consequence of the no-action alternative, however, because it could occur at any point in time, at license expiration, or whenever the applicant/licensee decides that the nuclear power plant is no longer economically viable and terminates reactor operations.

The impacts of the no-action alternative are the impacts from terminating reactor operations and preparing the nuclear power plant for decommissioning. The analysis should consider direct and indirect effects. The level of detail should be commensurate with the significance of the environmental impacts. The applicant may also summarize and incorporate by reference information from the LR GEIS to the extent practicable.

Further, the no-action alternative does not meet the purpose and need for the proposed action as stated in Section 1.3 of the LR GEIS (i.e., "...to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs"). Because energy needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers, it may require the applicant, power plant owners, State regulators, and/or system operators to take action to replace or compensate for lost power generation. The no-action alternative should consider the impacts of these actions, and the applicant may incorporate by reference the impacts from analyses developed for the replacement energy alternatives discussed in Section 7.1.

Chapter 8 Comparison of the Environmental Impact of License Renewal with the Alternatives

The ER should compare the environmental impacts of license renewal, reasonable energy replacement alternatives, and the no-action alternative to assist the NRC in determining "...whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable" (see 10 CFR 51.95(c)(4)). The applicant may present this comparison in any format, such as Tables 2.4-1 through 2.4-5 in the LR GEIS. The comparison discussion should emphasize the more significant environmental impacts.

Chapter 9 Status of Compliance

Pursuant to 10 CFR 51.45(d), an applicant must, in part, discuss in the ER the status of compliance with applicable environmental quality standards and requirements:

The environmental report shall list all Federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection.

Appendix F of the LR GEIS presents a brief discussion of Federal and State laws, regulations, executive orders, and other requirements that may apply to, or be triggered by, the renewal and continued

reactor operation at NRC-licensed nuclear power plants. These include Federal and State laws, regulations, and other requirements designed to protect the environment, including land and water use, air quality, aquatic resources, terrestrial resources, radiological impacts, solid waste, chemical impacts, and socioeconomic conditions.

Applicable Federal and State laws and regulations include the following:

- laws and regulations that could require the NRC or the applicant to undergo a new authorization or consultation process with Federal or State agencies outside the NRC; and
- laws and executive orders that could require the NRC, or laws that could require the applicant, to renew authorizations currently granted or hold additional consultations with Federal or State agencies outside the NRC.

Appendix F of the LR GEIS is provided as a basic overview to assist the applicant in identifying environmental and natural resources laws that may apply to, or be triggered by, the license renewal process. The descriptions of each of the laws, regulations, executive orders, and other directives are general in nature and are not intended to provide a comprehensive analysis or explanation of any of the items listed. Appendix F is not intended as a complete and final list, and the applicant is reminded that a variety of additional Federal, State, local, and regional requirements may apply to a license renewal application for a specific nuclear power plant site.

D. IMPLEMENTATION

The methods described in this RG will be used in reviewing applications for renewal of nuclear power plant operating licenses (initial LR or SLR), which include information under 10 CFR 51.45, 51.51, 51.52, and 51.53, with respect to compliance with applicable regulations governing the environmental review of operating nuclear power plants, unless the applicant proposes an acceptable alternative method for complying with those regulations. Backfitting, issue finality, and forward-fitting considerations do not apply to the NRC's use of this RG to support these NRC reviews.

E. REFERENCES¹⁴

1. *U.S. Code of Federal Regulations* (CFR), “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” Part 54, Title 10, “Energy.”¹⁵
2. CFR, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” Part 51, Title 10, “Energy.”
3. National Environmental Policy Act of 1969 (NEPA), as amended, 42 United States Code (U.S.C.) 4321 et seq.¹⁶
4. Executive Order 11514, “Protection and Enhancement of Environmental Quality.” *Federal Register*, 35 FR 4247, March 5, 1970, Office of the President, Washington, DC.
5. Executive Order 11991, “Environmental Impact Statements,” *Federal Register*, 42 FR 26967, May 25, 1977, Office of the President, Washington, DC.
6. CFR, “Chapter V – Council on Environmental Quality – Parts 1500 Through 1508,” Parts 1500-1508, Title 40, “Protection of Environment.”
7. Atomic Energy Act of 1954, as amended, 42 U.S.C. 2133 et seq.
8. Energy Reorganization Act of 1974, as amended, 42 U.S.C. 5841 et seq.
9. U.S. Nuclear Regulatory Commission (NRC), NUREG-1437, Revision 2, Final Report, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants,” Washington, DC. (ADAMS Accession No. ML24087A133).
10. NRC, NUREG-1555, Supplement 1, Revision 2, Final Report, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal” Washington, DC. (ML23201A227).
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12. NRC, “Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule.” *Federal Register*, 61 FR 66537. December 18, 1996, Washington, DC.

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