



REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 4.2, SUPPLEMENT 1

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PREPARATION OF ENVIRONMENTAL REPORTS FOR NUCLEAR POWER PLANT LICENSE RENEWAL APPLICATIONS

A. INTRODUCTION

This regulatory guide provides general procedures for the preparation of environmental reports (ERs) that are submitted as part of an application for the renewal of a nuclear power plant operating license in accordance with Title 10, of the *Code of Federal Regulations*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (10 CFR Part 54). This regulatory guide amends Supplement 1 to Regulatory Guide 4.2, "Preparation of Supplemental Environmental Reports for Applications To Renew Nuclear Power Plant Operating Licenses," issued September 2000. Use of this regulatory guide will help to ensure the completeness of the information provided in the ER, assist the U.S. Nuclear Regulatory Commission (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 regulatory guide 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 the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), as amended. The NRC published the license renewal provisions of 10 CFR Part 51 in the *Federal Register* on June 5, 1996 (61 FR 28467). 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.

The NRC issues regulatory guides to describe and make available to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency's regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff needs in reviewing applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission. Written suggestions regarding this guide or development of new guides may be submitted through the NRC's public Web site under the Regulatory Guides document collection of the NRC Library at <http://www.nrc.gov/reading-rm/doc-collections/reg-guides/contactus.html>.

Electronic copies of this regulatory guide and previous version of this guide and other recently issued guides are available through the NRC's public Web site under the Regulatory Guides document collection of the NRC Library at <http://www.nrc.gov/reading-rm/doc-collections/>. The regulatory guide is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under ADAMS Accession No. ML13067A354. The regulatory analysis may be found in ADAMS under Accession No. ML13029A471 and the staff responses to the public comments on DG-4015 may be found under ADAMS Accession No. ML13067A355.

On December 18, 1996 (61 FR 66537), 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), 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), to redefine the number and scope of the environmental impact issues that must be addressed during license renewal environmental reviews.¹ This amendment also incorporates lessons learned and knowledge gained from license renewal environmental reviews conducted by the NRC since 1996. Analyses conducted for and reported in NUREG 1437, Revision 1, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants” (GEIS), issued in 2013, support this amendment.

The GEIS evaluated 78 environmental issues and determined that 59 of these issues are adequately addressed for all applicable nuclear plants. The GEIS identifies these as Category 1 issues. The NRC will not require additional analysis in plant-specific environmental reviews unless new and significant information related to the conclusions in the GEIS needs to be considered. Of the remaining 19 issues, 17 are identified as Category 2 issues, which require plant-specific environmental assessments. Two issues (“Chronic effects of electromagnetic fields [EMFs]” and “Offsite radiological impacts of spent nuclear fuel and high-level waste disposal”) are not categorized at this time. The issue of chronic effects of EMFs remains uncategorized because there is no national scientific consensus on the potential impacts from chronic exposure to EMFs. For the second issue, the categorization was changed from a Category 1 issue to an uncategorized issue as a result of the the United States Court of Appeals, decision in *New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012) and the Commission’s response thereto, as set forth in CLI-12-16 (August 7, 2012). The *New York v. NRC* decision vacated the NRC’s Waste Confidence Decision and Rule, after finding that it did not comply with NEPA. In CLI-12-16, the Commission stated that it would not take any action that relied upon the Waste Confidence Decision and Rule, including issuance of final approvals on any license renewal applications, until the deficiencies identified in the *New York v. NRC* decision were resolved. The “Offsite radiological impacts of spent nuclear fuel and high-level waste disposal” issue, as set forth in the 1996 rule and in the 2009 proposed rule, relied upon the Waste Confidence Decision and Rule for its Category 1 classification. As part of its response to *New York v. NRC*, the Commission, in SRM-COMSECY-12-0016, dated September 6, 2012, directed the NRC staff to proceed with a rulemaking that includes the development of a generic EIS to support a revised Waste Confidence Decision and Rule and to publish both the EIS and the revised Waste Confidence Decision and Rule in the Federal Register within 24 months (by September 6, 2014). The NRC will make any necessary conforming amendments to its regulations in 10 CFR Part 51, supplement the GEIS, and update this regulatory guide, as necessary.

This regulatory guide contains information collection requirements covered by 10 CFR Part 51 that the Office of Management and Budget (OMB) approved under OMB control number 3150-0021. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

¹ The NRC issued the underlying proposed rule on July 31, 2009 (74 FR 38117). The NRC also issued the draft revised GEIS on the same date (74 FR 38239). The public comment period, which was extended, ended on January 12, 2010 (74 FR 51522).

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A.1 Environmental Review Process

After receiving an application for license renewal 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 supplemental environmental impact statement (SEIS) to the GEIS. NUREG-1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants,” Supplement 1, Revision 1, “Operating License Renewal,” issued in 2013, 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 renewal of the nuclear power plant’s operating license), no action (not renewing the plant’s operating license), and replacement power 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 license renewal safety review (under 10 CFR Part 54), before deciding to either issue or deny the issuance of the renewed 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 a license renewal environmental review and to prepare a plant-specific SEIS to the 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; affected American Indian Tribes; public interest groups; and any other persons expressing interest in the license renewal environmental review. The notice describes the proposed action and explains the NRC’s scoping process, provides information about public meeting locations and where copies of the ER are available for public examination, and invites members of the public to participate in the scoping process and environmental review.
- 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”; 10 CFR 51.95(c)(1); and 40 CFR 1506.6(b)(3), “Public Involvement”). The purpose of scoping is to identify environmental issues and invite members of the public, State and local agency officials, representatives of environmental interest groups, and others to participate in the scoping process and the environmental review. Scoping provides an opportunity for members of the public, environmental interest groups, and others to identify environmental issues they believe are significant, as well as to identify concerns about environmental issues that may not have been adequately addressed, or addressed at all, in the ER. Environmental issues may be introduced in statements made at the public scoping meeting or identified in written comments sent directly to the NRC or submitted via www.regulations.gov. During the scoping period, the NRC staff will visit the nuclear plant site and, upon request, meet with local, regional, and State officials; representatives of affected American Indian Tribes; and representatives of environmental interest groups. As a result of issues being raised during scoping, the NRC may request additional information from license renewal applicants.
- Prepare a plant-specific draft SEIS to the 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, as well as 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 Federal, State, and local agencies; affected American Indian Tribes; environmental interest groups, organizations, and individuals who have expressed interest and participated in the environmental review; and any other individuals who request a copy.
- Prepare the final SEIS to the 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 received on the draft SEIS and modify the SEIS to address any new and significant information, if necessary. After addressing public comments and considering the environmental impacts of license renewal, the NRC staff will 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. The NRC staff will then issue and deliver copies of 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; affected American Indian Tribes; environmental interest groups, organizations, and individuals who have expressed interest and participated in the environmental review; and any other individuals who request a copy.
- Hold a hearing on the license renewal application if the Commission determines that it is in the public interest or if a request for hearing and petition to intervene are granted by the Commission or a designated licensing board. In accordance with 10 CFR 2.105(a)(10), “Notice of Proposed Action,” the NRC will issue a notice of opportunity for hearing as soon as practicable after the application has been docketed. Any person whose interest may be affected by the 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 impacts of license renewal and power-generating 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 license renewal, the NRC will 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. The NRC will publish the Commission’s final decision on whether or not to renew the nuclear plant operating license in the *Federal Register*.

A.2 General Guidance to Applicants

Use of Regulatory Guides

The NRC issues regulatory guides to describe the methods and procedures used to implement specific parts of the agency's regulations, explain techniques used to evaluate specific problems or issues, and (in this case) to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with them is not required.

Environmental Reports—General Guidance

The ER should provide sufficient information to support each environmental impact assessment made by the applicant and the basis for findings (conclusions). Though other documents (e.g., the original ER or safety analysis report) may be referenced, the ER should summarize the information used in the impact assessment. In preparing the ER, the applicant must meet the general requirements set out in 10 CFR 51.45, "Environmental Report," in addition to the provisions of 10 CFR 51.53(c), "Postconstruction Environmental Reports—Operating License Renewal Stage," which are specific to license renewal ERs.

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 plant and identify Category 1 issues that do not apply to the plant. The ER should also contain any new and significant information that relates to a Category 1 issue (see "New and Significant Information" paragraph below). The ER can incorporate the findings in the GEIS 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 regulatory guide discusses an acceptable method 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 impact issue that was not considered or addressed in the GEIS and, consequently, not codified in Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants," in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)," of 10 CFR Part 51, or (2) information not considered in the assessment of impacts evaluated in the GEIS leading to a seriously different picture of the environmental consequences of the action than previously

considered, such as an environmental impact finding different from that codified in Table B-1.² 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 environment in a manner or an intensity and/or scope (context) not previously recognized. 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 the scoping and public comment periods. Section 5 of this guide that addresses ER Chapter 5 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 environmental impact issues in proportion to their significance as prescribed in the Council on Environmental Quality’s (CEQ’s) regulations for implementing NEPA at 40 CFR 1502.1, “Purpose,” and consistent with the definition of “significantly” at 40 CFR 1508.27, “Significantly.” In assessing the significance of environmental impacts, the applicant should conform to the following definitions of significance level used by the NRC in the 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.

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 1508.20, “Mitigation,” CEQ identifies five types of mitigative actions:

- a. Avoiding the impact altogether by not taking a certain action or parts of an action.
- b. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

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

- c. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- d. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- e. Compensating for the impact 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.

Cumulative, Direct, and Indirect Impacts

Environmental impacts, or effects, include direct effects, indirect effects, and cumulative effects. The assessment of environmental impact issues should consider each type of effect and should discuss each type of effect in proportion to the significance of the impact attributed to license renewal (see “Impact Findings” above). The CEQ regulations at 40 CFR Part 1508, “Terminology and Index,” define the three types of effects. In particular, 40 CFR 1508.7, “Cumulative Impact,” provides the following definition:

“Cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

In addition 40 CFR 1508.8, “Effects,” defines direct and indirect effects as follows:

“Effects” include:

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

B. STANDARD FORMAT AND CONTENT OF ENVIRONMENTAL REPORTS

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 (i.e., issuance of a renewed nuclear plant operating 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 deny a license renewal application, the NRC does not have a role in the energy-planning decisions of 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 plant, and replacement power alternatives. The applicant should also describe any proposed refurbishment activities, programs, and activities for managing the effects of aging and future employment estimates during the license renewal term.

2.1 The Proposed Action

The proposed action is the issuance of a renewed nuclear plant operating license, leading to continued operations and maintenance activities during the renewal license term and all other associated activities. These may include refurbishment and other upgrade activities to allow for extended nuclear plant operation and changes to surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR). The applicant may undertake refurbishment and SMITTR activities because of requirements resulting 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 activities associated with license renewal that can affect the environment. The level of detail provided should also be sufficient to support the impact assessments called for in Section 4 of this regulatory guide. For reference, Chapter 2 of the GEIS discusses possible activities associated with license renewal.

As described in 10 CFR 51.53(c)(2), the ER 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 plant and the operation, inspection, maintenance, and refueling activities and practices directly related to the plant operations under license renewal. Information presented in this section should describe the following systems.

Reactor and Containment Systems

This section of the ER should briefly describe the 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 water withdrawal, 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. 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 (for cooling towers), blowdown, effluent, and the like. 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 surface water and impingement and entrainment sections of the ER should refer to this section when appropriate to avoid unnecessary duplication of effort.

Radioactive Waste Management

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

The applicant should provide in the ER a brief plant-specific description of the major features of the liquid, gaseous, and solid radioactive waste management system. The information should include, at a minimum, a physical description of the systems and the types of treatment used (e.g., filtration, demineralizers, dewatering, and resin filtration for liquid wastes), a discussion about the use of an offsite waste processor, and details of the transportation and disposal of the waste and onsite storage facilities.

Nonradioactive Waste Management

Each nuclear power plant has a nonradioactive waste system to collect, treat, and dispose of the nonradioactive wastes that are byproducts of plant operations. The EPA, in accordance with the Resource Conservation and Recovery Act of 1976, as amended, classifies certain nonradioactive wastes as hazardous based on characteristics including ignitability, corrosivity, reactivity, and toxicity. State regulators may add wastes to the EPA list of hazardous wastes.

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

Power Transmission Systems

In this section of the ER, the applicant should list and describe the in-scope transmission lines, including the length of the transmission lines or portions 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

This section should describe any refurbishment activities performed in support of or otherwise associated with license renewal. It should identify major facility modifications at the nuclear 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. It should also briefly describe the location and nature of environmental impacts if refurbishment activities will directly or indirectly affect the environment.

This section of the ER should also 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 outages and/or other maintenance activities. It should also list any Federal, State, and local permits needed for the refurbishment and their status. Applicants should ensure that Chapter 4 of their ER addresses the environmental effects of refurbishment activities described in this section.

2.4 Programs and Activities for Managing the Effects of Aging

This section 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 significantly different from those described in the final environmental statement for the current operating license should be described in detail.

2.5 Employment

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

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

This section should describe any anticipated changes in the size of the permanent onsite workforce during the license renewal term arising from changes in SMITTR activities. 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 also 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 deciding whether to renew the operating license, the NRC must consider the environmental impacts of replacement power alternatives, as well as those of the proposed action. 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 and select replacement power alternatives, which are discussed in greater detail in Section 7.1 of this regulatory guide. Applicants should briefly describe all of the replacement power alternatives considered and indicate which alternatives they evaluated in detail in their ERs.

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). Section 7.2 of this regulatory guide describes these alternatives in greater detail.

Chapter 3 Affected Environment

This chapter identifies information that NRC reviewers need in order to describe the plant's environmental setting. This chapter of the ER 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 period:

- Describe the site location, including the State, county, town, township, service districts, and parish boundaries, as appropriate. Provide maps showing the boundaries of such political jurisdictions.
- Include a map, or maps, of the site showing site boundaries; the exclusion area; site structures and facilities; major land uses (with land use classification consistent with the U.S. Geological Survey (USGS) categories given in “USGS NLCD Land Cover Class Definitions,” issued in 2010; the construction zone for refurbishment, if any; sites for any other planned buildings and structures (both temporary and permanent); and transportation routes adjacent to the site.
- Provide a map of the site vicinity within a 6-mile (10-kilometer) radius of the site and of the region within 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, American Indian and/or Bureau of Indian Affairs lands held in trust for American Indians, Indian Tribes’ lands, military reservations, and military facilities. Depict requested features on both the vicinity and regional map(s) as practicable, given the varying map scales.
- Identify and describe known and reasonably foreseeable Federal and non-Federal projects and other actions in the vicinity of the site that may contribute to the cumulative environmental impacts of license renewal and extended plant operation.
- Identify all Federal facilities, including national parks, national forests, national wildlife areas, military facilities, and military reservations; American Indian and/or Bureau of Indian Affairs lands held in trust for American Indians; Indian Tribes’ lands; 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.

3.1 Land Use and Visual Resources

Land Use

In this section of the ER, the applicant should provide information, including area and percentage by land use and land cover category, about the undeveloped portions of land within the plant site boundary and/or property. Onsite land use or land cover can be divided into four basic categories: (1) the amount of developable unused open portions of the site, including fields and forest uplands, (2) the amount of nondevelopable wetlands and open water bodies (i.e., marshes, bogs, swamps, streams, ponds, estuaries, and rivers), (3) the amount of developed portions of the plant site, including facilities, structures, parking areas, landscaped areas, leased lands, and visitor and recreation areas, and (4) the amount of onsite land that has been disturbed at some time during the construction and operation of the plant. The applicant should also provide a map of the site vicinity within a 6-mile (10-kilometer) radius of the plant showing major land uses and land cover (with land use classifications consistent with the USGS categories). The applicant should include information on local county comprehensive land use and development plans concerning land use and zoning that are relevant to population and housing growth and control and to changes in land use patterns.

Visual Resources

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

3.2 Meteorology and Air Quality

In this section, the applicant should provide information that includes a description of the local and regional meteorology and climatology from nearby representative sites with a sufficiently long period of record (i.e., at least 30 years). The applicant should also provide a summary of current local air quality with respect to criteria pollutants established under the National Ambient Air Quality Standards (40 CFR Part 50); a list of nonattainment and/or maintenance areas; and the most recent site emissions data for all criteria pollutants and volatile organic compounds, any air toxics (i.e., hazardous air pollutants) that are locally important, and greenhouse gases. The applicant should also identify the pollutant or pollutants for which each area is in nonattainment or maintenance, as well as the severity of nonattainment, as applicable. The applicant should also describe the onsite meteorological monitoring program and meteorological data monitoring system, as well as onsite stationary emission sources and applicable permits. Additionally, the applicant should include a map of the region within a 62-mile (100-kilometer) radius of the site of nonattainment and/or maintenance areas (as defined under the Clean Air Act [42 U.S.C. 7401 et seq.], as amended) and a list of mandatory Class I Federal areas within the same radius.

In addition, if the applicant plans any refurbishment activities (see Section 2.3) that would require large numbers of 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):

- 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,³ 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.⁴
- 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.⁵

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

3 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 <http://www.epa.gov/ttn/chief/ap42>.

4 Information on the most current EPA modeling tools for calculating vehicle emissions may be obtained at <http://www.epa.gov/otaq/models.htm>.

5 Emissions for these sources can be calculated using EPA's NONROAD model available at <http://www.epa.gov/oms/nonrdmdl.htm>.

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 provide information about current or past noise studies and analyses conducted at or near the nuclear plant site. In particular, the applicant should provide information about noise complaints and identify the loudest onsite noise-generating facilities and activities and indicate their distance to the nearest site boundary. If ambient noise studies have been conducted, the locations of the measurements and the corresponding noise levels, along with meteorological conditions during the measurement period, should be included.

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. 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") and should describe best management practices to control erosion and runoff associated with continued plant operations and refurbishment activities. 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 of 1981, as amended (7 U.S.C. 4201 et seq.).

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 and briefly described. A brief discussion of

the flooding history of the plant site, if any, since construction should also be provided. 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 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.

Groundwater Resources

This section 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 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. 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. 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 groundwater contamination.

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

3.6 Ecological Resources

Ecological resources include members and attributes of aquatic, terrestrial, riparian, and wetland plant and animal communities. The NRC generally includes wetland and riparian habitats with terrestrial

ecology. Wetlands and riparian habitats are the interface between aquatic and terrestrial habitats, as further defined by EPA/840/B-92/002, "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters," issued January 1993, as follows:

[Wetlands are] those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

[Riparian areas are] vegetated ecosystems along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body. These systems encompass wetlands, uplands, or some combination of these two land forms. They will not in all cases have all of the characteristics necessary for them to be classified as wetlands.

Region

The ER should describe the ecoregion, ecosystems, and habitats surrounding the site; the geomorphic, or physiographic, province; characteristic vegetation and animal species, including climax vegetation and typical succession in the area of the site; the marine ecoregion, if the plant is located near an ocean or estuary; and the watershed and names and locations of source and receiving water bodies for the plant's cooling system.

Site and Vicinity

The ER should describe the local environment of the site, including soil types; water and sediment quality; vegetation and animal communities; physiographic habitats such as upland forest, swamps, marshes, wetlands, rivers, streams; and significant water bodies that intersect or parallel transmission lines. Significant water bodies include any perennial water bodies, such as oceans, rivers, lakes, streams (e.g., first order), ponds, and manmade reservoirs, impoundments, channels, or canals and any surface water features depicted on USGS 7.5-minute topographic maps or that normally support flowing water or hold water during at least part of the year. The applicant should also include detailed maps and descriptions, as appropriate.

Potentially Affected Water Bodies

The ER should describe the location of the site, in river miles, if appropriate, with respect to the principal nearby water bodies that it affects. The applicant should also describe the source and receiving water bodies in terms of their relationship to the watershed; size; shoreline; bathymetry; tidal and net flows, including seasonal or occasional variations; substrata; and sediment and water quality. This section should include the location of the main channel, dams, and flood control and describe uses of the water body other than as cooling water.

Ecological Resources History

The ER should provide a short description of the ecological environment of the plant site and vicinity before plant construction and the transition of the environment on the site from before plant construction to the present. This description should include major changes or modifications to the land and water bodies over the projected life of the plant. Typically, the applicant should describe channelization, navigation, pollution, habitat degradation or fragmentation, urbanization, development,

and pond or reservoir creation. This description should also include pollution control or other programs designed for environmental improvement. The ER should briefly describe major wildlife living around the site in the past and the species that remain today.

Places and Entities of Special Ecological Interest

The ER should provide the occurrence, location, and description of communities and habitats of special ecological interest in the vicinity of the plant, such as wetlands, natural heritage areas and other areas of public or scientific interest, or other areas that may be particularly sensitive or susceptible either directly or indirectly to the effects of continued plant operations and refurbishment.

Aquatic Communities

The ER should briefly describe the aquatic communities based on available information (e.g., present and past studies, Federal and State sources). This description should focus on a subset of representative and important species of fish, other aquatic vertebrates, macroinvertebrates, zooplankton, phytoplankton, and macrophytes. The selected species should include those with some or all of the following characteristics: potential or reported susceptibility to impingement and entrainment; dominance, commonness, or rarity in numbers or biomass; importance to the structure and function of the ecosystem, such as keystone species, important trophic links, potential for trophic cascade, or habitat formers or modifiers; indicators of water quality or “ecosystem health”; importance to recreational or commercial fishing and shellfishing; reported in fish consumption advisories; and having a role in ecosystem services.⁶

Terrestrial Communities

The ER should describe the terrestrial communities using available information (e.g., present and past studies, Federal and State sources) and include representative species of plants, mammals, birds, reptiles, and amphibians. This description should note any endemic species, sensitive or indicator species, or keystone species. The applicant should also describe select bird species that nest within the area, migratory species, known migratory bird rookeries, and, if applicable, the location of the plant site in relation to any nearby flyways. Additionally, the applicant should describe the types of vegetative communities found on and in the vicinity of the site, especially any delineated wetlands or potential wetland habitat. This section should summarize any available botanical and wildlife surveys conducted on or in the vicinity of the site.

Invasive Species

The ER should identify occurrences of aquatic and terrestrial invasive species in the vicinity of the plant and document any management activities undertaken by the plant to control such species.

Procedures and Protocols

The ER should describe how the applicant adheres to any applicable wildlife management plans and uses applicable or required (by permit) best management practices, including but not limited to, when applying pesticides and herbicides or when performing routine ground-disturbing activities to maintain the site and in-scope transmission lines.

6 Consideration of ecosystem services is addressed in National Research Council, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*, The National Academies Press, Washington, DC, 2004.

Maps

The ER should include detailed maps containing the site and in-scope transmission line ROWs; stream crossings; rivers; other bodies of water; wetlands; designated Federal, State, and local parks and natural areas; significant natural heritage areas; and known locations of historic migratory bird rookeries and other significant information.

Studies and Monitoring

The ER should briefly summarize any ecological studies or monitoring programs on or in the vicinity of the site and include the locations, dates, objectives, methods, and results applicable to the license renewal application. The applicant should also identify the relevant data or data summaries that might be available for NRC review.

Threatened, Endangered, and Protected Species and Essential Fish Habitat

This section of the ER should include information on Federal- or State-listed threatened and endangered species, critical habitat, and essential fish habitat (EFH), as well as any species that are protected under other legislation, including the Marine Mammal Protection Act, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act, as outlined below:

- Endangered Species Act. The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), was enacted to protect threatened and endangered species and the critical habitat on which they depend. In accordance with Section 7 of the Endangered Species Act, Federal agencies must review actions they undertake or support (such as issuing permits and licenses) to determine whether they may jeopardize the continued existence of any endangered species or their habitats. If such review reveals the potential to adversely affect listed or candidate species, the Federal agency must consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (NMFS) (collectively, the Services), as appropriate. The Services implement the interagency cooperation provisions of Section 7 at 50 CFR Part 402, “Interagency Cooperation—Endangered Species Act of 1973, as Amended.”⁷

The applicant should determine if Federally listed threatened, endangered, or candidate species, critical habitat, or State-listed species and habitat have the potential to occur on the site or in the vicinity of the site, including the area within the applicant’s in-scope transmission line ROWs. For such species, the applicant should provide the best available information on historical occurrences, population size and trends, critical habitat, and potential habitat to aid the NRC in its biological assessment. The applicant should discuss any license renewal activities and modifications to plant operation that may affect such species and habitats.

- Essential Fish Habitat (EFH). The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) set forth, among other things, a new mandate for Federal action agencies to identify and protect important marine and anadromous fish habitat. Under the Act, the Fishery Councils, assisted by NMFS, must delineate EFH in fishery management plans or amendments to fishery management plans for all managed species. The Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity,” and the Act’s EFH provisions seek to maintain sustainable

7 An explanation of the structure and implementation of the Endangered Species Act is found in Ray Vaughan, *Endangered Species Act Handbook*, Government Institutes, Inc., Rockville, MD, 1994.

fisheries by protecting habitat required by the fish.⁸ The regulations also direct the Councils to designate a second, more limited habitat designation within EFH for each species, known as a “habitat area of particular concern,” on the basis of the importance of the ecological function provided by the habitat; 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 rarity of the habitat type. The designation of habitat of particular concern does not confer additional protection or restrictions on an area of EFH.

Federal action agencies such as the NRC that fund, permit, or carry out activities that may adversely affect EFH are required to consult with NMFS about the potential adverse effects of their actions on EFH, where an adverse effect is defined as “any impact which reduces quality and/or quantity of EFH...[and] may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species’ fecundity), site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions.” If a project may have an adverse effect on EFH, NMFS is required to develop EFH conservation recommendations for the project.

If license renewal has the potential to affect any EFH, the NRC will prepare an EFH assessment that will describe how any such habitat might be affected as part of the environmental review process. The applicant should include sufficient information to aid the NRC in its EFH assessment. For such species, the applicant should provide information similar to that provided for protected species, which should include historical occurrences, population size and trends, important trophic links, identified EFH habitat, and potential or reported susceptibility to impingement, entrainment, and thermal impacts. The applicant should discuss any license renewal activities and modifications to plant operation that may affect such species and habitats.

- Other Acts. Several Federal laws, including the Marine Mammal Protection Act, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act, also mandate the protection of certain species. The ER should discuss protected species that have the potential to occur on or in the vicinity of the site or in-scope transmission line ROWs. In making the requested assessment, the applicant should use available information from the NMFS, U.S. Fish and Wildlife Service, State fish and wildlife agencies, and other knowledgeable organizations.

3.7 Historic and Cultural Resources

The applicant should use Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (16 U.S.C. 470 et seq.), as a guide for providing historic and cultural resource information about the nuclear plant site. The ER should include the information detailed below to assist the NRC staff in its review of the potential impacts to historic and cultural resources during the license renewal period.

The applicant should identify any activities associated with continued operations and refurbishment activities that could affect onsite or offsite historic properties.⁹ Such activities include

8 A primer on the Magnuson-Stevens Fishery Management and Conservation Act and its EFH provisions is available from the National Marine Fisheries Service, entitled “Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies,” at <http://www.nero.noaa.gov/hcd/finprim.pdf>.

9 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

ground-disturbing activity, increases in traffic, and audio and visual intrusions. The applicant should identify the area of potential effects¹⁰ on a site map.

Historic and Cultural Information

The applicant should summarize in the ER the land use history of the plant site and immediately surrounding area in order to identify historic and cultural resources on the plant site, including a plat map or other similar historical maps. Plat and other historic maps show ownership, acreage, property boundaries, and the location of existing or former historic structures. 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. The applicant should also summarize the cultural history of the area (including the plant site) from the beginning of human settlement to the 20th century.

This section of the ER should identify and describe historic properties and cultural resources within the area of potential effects. The applicant should summarize previous investigations and studies that pertain to or have occurred within the area of potential effects. The applicant should also describe any activities that have taken place on the plant site to determine the presence of historic and cultural resources. In addition, this section should indicate whether a records review for historic structures and cultural resources was conducted.

If the plant site has not been surveyed for historic and cultural resources, then the applicant should conduct reconnaissance or pedestrian surveys. The applicant should initiate informal consultation and conduct investigations to assist in identifying onsite historic and cultural resources with a contractor who is approved by the State Historic Preservation Officer (SHPO) and meets the U.S. Secretary of the Interior's standards. In consultation with the SHPO and appropriate American Indian Tribes, the applicant should evaluate the significance of the historic and cultural resources and assess any effects the plant may have on them. Additionally, the applicant should identify, evaluate, and describe protection measures for historic and cultural resources through consultation with the SHPO. The ER should include a summary of this information, as well as copies of correspondence with the SHPO, Tribes, or members of the public whom the applicant used to assess historic and cultural resources within the area of potential effects.

Procedures and Integrated Cultural Resources Management Plans

If historic properties or cultural resources are located within the area of potential effects, the applicant should establish procedures or implement an integrated management plan to protect the historic and cultural resources identified within the area of potential effects. 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.

properties that meet National Register listing criteria." National Register criteria for listing are found in 36 CFR Part 60, "National Register of Historic Places."

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."

3.8 Socioeconomics

The ER should include the following information to assist the NRC staff in its review of the potential socioeconomic impacts during the license renewal period:

- Based on information provided in Section 2.5, provide current employee residential distribution information in a table showing the number of applicant employees by county and community. Also identify where outage employees stay during refueling and maintenance outages. Identify the likely commuter routes for the workers and traffic conditions on those roads.
- Describe public recreational facilities and tourist attractions located in the vicinity of the plant site, including the present and projected percentage of use where available.
- Discuss and provide a table showing the distribution of property tax payments and other forms of agreed-to 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 revenues or property tax revenue for each jurisdiction and school district.
- Discuss any adjustments to these payments caused by reassessments and other actions (including legal actions) that resulted in notable increases and 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.

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,
- information on potential changes in radiological impacts to the public and workers from continued plant operations during the renewal term, and
- information on the radiological impacts of any planned refurbishment activities.

Microbiological Hazards

Microorganisms that are associated with cooling towers and thermal discharges can have negative impacts on human health. The presence and numbers of these organisms can be increased by the addition of heat; thus, they are called thermophilic organisms. These microorganisms include the enteric pathogens *Salmonella* spp. and *Shigella* spp., as well as *Pseudomonas aeruginosa* and thermophilic fungi. They also include the bacteria *Legionella* spp., which causes Legionnaires' disease, and free-living amoebae of the genera *Naegleria* (*Naegleria fowleri*) and *Acanthamoeba*. 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. 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 of 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 applicant should determine whether any locations within the in-scope transmission line ROWs do not meet current National Electric Safety Code (NESC) clearance standards. The ER should describe the methodology used to make this determination. The applicant should also include in the ER maps, photographs, or drawings indicating the locations of all sites that do not meet the NESC clearance standards.

3.10 Environmental Justice

To assist the NRC staff in its review of potential human health impacts that could occur during the license renewal period, the applicant should describe the general demographic composition of minority and low-income populations and communities (by race and ethnicity) residing in the immediate vicinity of the plant that could be affected by ongoing and future plant operations and license renewal activities. The geographic scale should be commensurate with the potential impact area and include a sample of the surrounding population to facilitate the evaluation of the communities, neighborhoods, and areas that may be disproportionately affected. This discussion should cover all areas with actual, or potential, reasonably foreseeable physical, social, cultural, and health impacts. The ER should include information about migrant workers as well as full-time residents and provide geographic information about the location of these populations and communities. Migrant workers are distinguished from full-time residents as follows: migrant workers are those who move from one location to another in response to various employment opportunities such as employment associated with seasonal farming, construction, and manufacturing. Most migrant workers are foreign-born individuals living in the United States as either citizens or noncitizens and may reside in unconventional housing arrangements.

3.11 Waste Management

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

- a description of the radioactive and nonradioactive waste management systems 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 off site for processing or disposal; and

- descriptions, names, and locations of facilities currently used and likely to be used in the future for offsite processing and disposal of wastes.

Chapter 4 Environmental Consequences of the Proposed Action and Mitigating Actions

General Guidance

As previously discussed, the GEIS evaluates 78 environmental NEPA issues, and analyses have determined that 59 of these issues, identified as Category 1 issues in the 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 Part B of this regulatory guide, 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 GEIS for Category 1 issues if no new and significant information is discovered.

Of the remaining 19 NEPA issues, 17 are identified as Category 2 issues, which require plant-specific environmental assessments. The following sections discuss information that the applicant should include in the ER to assist the NRC staff in evaluating the impacts of these 17 Category 2 issues. Two issues (“Chronic effects of electromagnetic fields [EMFs]” and “Offsite radiological impacts of spent nuclear fuel and high-level waste disposal”) are not categorized at this time. The issue of chronic effects of EMFs remains uncategorized because there is no national scientific consensus on the potential impacts from chronic exposure to EMFs. The NRC staff discusses this situation in the GEIS and in plant-specific supplements to the GEIS. For the second issue, the categorization was changed from Category 1 to uncategorized issue as a result of the the United States Court of Appeals, decision in *New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012) and the Commission’s response thereto, as set forth in CLI-12-16 (August 7, 2012). The *New York v. NRC* decision vacated the NRC’s Waste Confidence Decision and Rule, after finding that it did not comply with NEPA. In CLI-12-16, the Commission stated that it would not take any action that relied upon the Waste Confidence Decision and Rule, including issuance of final approvals on any license renewal applications, until the deficiencies identified in the *New York v. NRC* decision were resolved. The “Offsite radiological impacts of spent nuclear fuel and high-level waste disposal” issue, as set forth in the 1996 rule and in the 2009 proposed rule, relied upon the Waste Confidence Decision and Rule for its Category 1 classification. As part of its response to *New York v. NRC*, the Commission, in SRM-COMSECY-12-0016, dated September 6, 2012, directed the NRC staff to proceed with a rulemaking that includes the development of a generic EIS to support a revised Waste Confidence Decision and Rule and to publish both the EIS and the revised Waste Confidence Decision and Rule in the Federal Register within 24 months (by September 6, 2014). The NRC will make any necessary conforming amendments to its regulations in 10 CFR Part 51, supplement the GEIS, and update this regulatory guide, as necessary.

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 (P), (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 A.2 of this regulatory guide.

The applicant should assess direct, indirect, and cumulative effects. The cumulative or indirect effects of the action may be of moderate or large significance even when the effect directly related to license renewal is small. Section A.2 of this regulatory guide 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 A.2 of this regulatory guide 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

Impacts to land use and visual resources are evaluated in the GEIS and are considered to be 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 visual impacts do not need further assessment.

4.2 Air Quality

Impacts to air quality are evaluated in the GEIS and are considered to be 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 further assessment.

4.3 Noise

Noise impacts are evaluated in the GEIS and are considered to be 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 further assessment.

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 GEIS and are considered to be 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 further assessment.

4.5 Water Resources

The GEIS reviews the following water resources-related Category 2 issues, which 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, “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 of the 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)

This section applies to plants using more than an annual average of 100 gallons per minute (gpm) (6 liters per second (L/s)) of groundwater.

Table B-1 states, “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 of the 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 (6 L/s) 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 (6 L/s), 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 onsite wells, 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 ... 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 of the GEIS discusses this issue. Additional groundwater 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 Section 4.5.1) 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 at Inland Sites)

This section applies to plants at inland sites that have cooling ponds.

Table B-1 states the following:

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

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

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

Section 4.5.1.2 of the GEIS also discusses this issue. If the plant does not use cooling ponds or if the cooling ponds are adjacent to salt marshes, the applicant should note this fact in the ER and need not provide further information.

Information and Analysis Content

If the plant uses cooling ponds and is not adjacent to salt marshes, 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 of the GEIS discusses this issue.

Information and Analysis Content

Each nuclear power plant has committed to following the guidance developed by the Nuclear Energy Institute (NEI) contained in NEI 07-07, “Industry Ground Water Protection Initiative—Final Guidance Document,” issued August 2007. 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 groundwater. Because each nuclear power plant has developed a site-specific groundwater protection program, the NRC staff must review the details 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 (i.e., reports required by 10 CFR 20.2202, 10 CFR 20.2203, and 10 CFR 50.72(b)(2)(xi), as well as from reports issued in accordance with the reporting criteria contained in NEI 07-07) inadvertent releases of radionuclides into groundwater:

- 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 the groundwater.

4.6 Ecological Resources

The GEIS reviews the following ecological resources-related Category 2 issues, which require a plant-specific assessment.

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

The applicant should provide sufficient information in the ER to put any effects of plant operation in perspective in terms of the stability of populations and other such properties of ecosystem structure and function and alteration in ecosystem services. 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 a further discussion of these services, see “Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems,” published in *Issues in Ecology* by Daily et al., 1997.

For all ecological issues, the same general approach can identify the environmental consequences of license renewal and its alternatives. This approach, consisting of the steps detailed below, generally follows the framework in EPA/630/R-95/002F, “Guidelines for Ecological Risk Assessment,” issued April 1998.

1. Identify the Relevant Sources of Information

While Chapter 3 of the ER should generally describe the potentially affected environment, this section should identify the specific information and sources used for assessing impacts and include the following:

Studies and monitoring programs. Briefly summarize any studies or monitoring programs that provide site-specific data or data that may be relevant to the site and explain environmental impacts. Include the location, dates, objectives, biological entities, or attributes chosen for study, the methods, and the results applicable to the license renewal application, as well as any data or data summaries that might be available for NRC staff review. If data are older than 5 years, explain why the studies would or would not be relevant for assessing the effects of present and projected future plant operation over the term of license renewal. For example, demonstrate that both the potentially affected resources and the effect of the plant on them have remained and can be expected to remain unchanged over the term of license renewal.

Communications with regulatory agencies. Document any communications with regulatory agencies (e.g., EPA or other water quality permitting agencies) and resource agencies (e.g., NMFS, U.S. Fish and Wildlife Service, State fish and wildlife agencies) relevant to assessing impact and not documented elsewhere in the ER. If relevant communications are documented elsewhere, refer the reader to the appropriate sections.

Other sources. Provide in-text citations of sources of data and information used to assess impacts and provide a list of the literature cited.

2. Identify Resources To Be Analyzed for the Issue

While Chapter 3 of the ER should contain an overview of biological resources, this section should identify the specific resources or their attributes used for assessing impact. Because biological systems are complicated, only a subset of resources can be addressed as described below:

Identify potentially affected resource entities. Describe the potentially affected resources in terms of representative species, functional group of species (e.g., insectivores), communities, an ecosystem (e.g., oak-hickory forest), a specific valued habitat (e.g., wet meadows), a unique place, or other entity of concern. Contact Federal, State, and regional government agencies with jurisdiction over biological resources to assist with the identification of important species and habitats.

Identify attributes of those resources potentially at risk. For the susceptible resources, identify the characteristics that are important to protect and potentially at risk. If potentially adverse effects on a species, habitat, or other resource are identified, assess the resource with respect to social, economic, and ecological values at the local, regional, and national levels.

3. Show the Relationships between Plant Operation and the Resource Attributes

To be considered an indicator of impact, a causal link must exist between the attributes of a resource and plant operation. To be useful in assessing any impacts, the resource attribute that one measures must be causally linked to some aspect of plant operation.

If any adverse impacts are identified, the mitigation measures that have been used to reduce the adverse impacts during the initial license period or that are expected to be used during the license renewal period and their expected effects should be described. The rationale for not implementing any measures that were considered but rejected should be explained.

4.6.2 Terrestrial Resources

Effects on Terrestrial Resources (Non-Cooling System Impacts)

Table B-1 states the following:

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

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 of the GEIS discusses the non-cooling system impacts on terrestrial resources. The applicant should describe any known and reasonably foreseeable activities associated with license renewal and continued operations, maintenance, and refurbishment that will disturb terrestrial habitat. If no area will be disturbed or if an area to be disturbed contains no terrestrial habitat (i.e., industrial plant areas), the applicant should note that fact, and no further discussion of the issue is needed. Chapter 4 of

the ER should describe areas that will be disturbed with respect to (1) the amount of land to be disturbed, (2) ecological characteristics of the habitat, (3) species of plants and animals found in the area, and (4) the extent to which the habitat is unusual. Note that the information and analysis for this issue overlap the information and analysis for assessing impacts on threatened and endangered species, where applicable.

Information and Analysis Content

The ER format should follow the general approach for information and analysis content in the ER for all ecological resource issues as described at the beginning of this section (see Section 4.6.1). In addition, if continued operations, maintenance, or refurbishment activities will disturb any plant or wildlife habitat, the applicant should describe the habitat that will be disturbed during the transport and delivery of equipment, structures, or components; in material laydown areas; and in construction areas associated with license renewal. If any temporary or permanent structures will be built, the ER should provide a map of the site that shows the proposed location of these structures. If any road or bridge modifications will occur as a result of transport, the ER should describe the potential effects on the terrestrial environment.

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

This section applies to plants with cooling ponds or cooling towers using makeup water from a river. Table B-1 states, “Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of moderate significance.”

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 of the GEIS discusses surface water use conflicts for terrestrial resources. 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

The ER format should follow the general approach for information and analysis content for all ecology issues as described at the beginning of this section (see Section 4.6.1).

4.6.3 Aquatic Resources

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

This section applies to plants with once-through and cooling pond heat dissipation systems. Table B-1 states the following:

The impacts of impingement and entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling

systems, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.

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 heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations...or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from...impingement and entrainment.

Section 4.6.1.2 of the GEIS discusses this issue. If the plant does not use a once-through cooling or cooling pond heat dissipation system, the applicant should note this fact in the ER and need not provide additional information.

If the plant uses a once-through or cooling pond heat dissipation system and the applicant holds a current Section 316(b) determination under the Clean Water Act of 1972, as amended (33 U.S.C. 1251 et seq.) (i.e., coinciding with the plant's most recent NPDES permit renewal application), the applicant should provide the NRC with copies of the determination, supporting documentation, and relevant correspondence with the water quality permitting agency (EPA or the permitting State agency). Additionally, the applicant should describe any potential mitigation measures and state whether they will be or have been implemented.

If (1) the plant uses a once-through or cooling pond heat dissipation system and (2) the applicant does not possess a current Clean Water Act Section 316(b) determination, the applicant must consider issues of impingement and entrainment of fish and shellfish. Information that should be provided, if available, to the NRC for review and analysis of the impingement and entrainment issue is outlined below.

Information and Analysis Content

The ER format should follow the general approach for information and analysis content for all ecology issues as described at the beginning of this section (see Section 4.6.1). The following is specific guidance for this issue:

- Document any communications with regulatory agencies (e.g., EPA or other water quality permitting agencies) and resource agencies (e.g., NMFS, U.S. Fish and Wildlife Service, State fish and wildlife agencies) about the issues of impingement and entrainment. Provide a copy of any Clean Water Act Section 316(b) determination. If a determination has not been made that the "location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact," discuss the outstanding issues.
- Briefly summarize any impingement or entrainment studies or monitoring programs and include the location, dates, objectives, methods, and results applicable to the license renewal application, as well as any data or data summaries that might be available for NRC review. Provide estimates of the species and numbers of fish and shellfish impinged and entrained on a daily, monthly, and annual basis. Provide site-specific estimates of the mortality of impinged fish and shellfish.
- Provide estimates of the number of fish and shellfish lost to the water body because of impingement and entrainment. Provide full documentation of analytical or modeling techniques

used to assess entrainment and impingement losses. Describe these losses in terms of the commercial, recreational, and ecosystem services they would have provided.

- If aquatic resources have been monitored in the field, provide an analysis of temporal and geographical trends in the data that might indicate whether fish and shellfish populations have increased, decreased, or remained stable during the current period of operation. Show any relationships between patterns of impingement and entrainment at the plant and trends in the potentially affected populations. Discuss the mitigation measures in place to reduce impingement and/or entrainment (e.g., fish return system, sound barriers, hatchery operations). Because entrainment, impingement, and thermal impacts all affect field populations simultaneously, provide a single discussion of the effects of these stressors on trends in the field data rather than discussing these three stressors individually, if possible.

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

This section applies to plants with once-through and cooling pond heat dissipation systems. Table B-1 states the following:

Most of the effects associated with thermal discharges are localized and are not expected to affect overall stability of populations or resources. The magnitude of impacts, however, would depend on site-specific thermal plume characteristics and the nature of aquatic resources 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 heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations and, if necessary, a 316(a) variance in accordance with 40 CFR Part 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from thermal changes....

Section 4.6.1.2 of the GEIS discusses this issue. If the plant does not use a once-through cooling or cooling pond heat dissipation system, the applicant should note this fact in the ER and need not provide additional information.

If the plant uses a once-through or cooling pond heat dissipation system and the applicant holds a valid NPDES permit demonstrating that the plant meets State water temperature standards or a current Clean Water Act Section 316(a) variance determination (i.e., coinciding with the plant's most recent NPDES permit renewal application), the applicant should provide copies of the determination, NPDES permit, supporting documentation, and relevant correspondence with the water quality permitting agency (EPA or the permitting State agency) to the NRC. In the case of a valid permit that has expired but has been administratively continued by the permitting authority upon the timely submission (i.e., at least 180 days before the permit expiration date) of an applicant for renewal, the permit renewal application should also be provided. Additionally, the applicant should describe any potential mitigation measures and state whether they will be or have been implemented.

If (1) the plant uses a once-through or cooling pond heat dissipation system and (2) the applicant does not possess a valid NPDES permit demonstrating that the plant meets State water temperature standards or does not possess a current Clean Water Act Section 316(a) variance determination, the applicant must

consider issues of thermal impacts in the ER. If a plant has a valid NPDES permit or current Section 316(a) variance determination with no associated mitigation measures, then the applicant should summarize the conditions established by the regulatory agency and, including the plant's compliance status with these conditions, and provide a copy of the valid NPDES permit or Section 316(a) variance determination, or both. Otherwise, the information that the applicant should provide for the review and analysis of the thermal impacts issue is outlined below.

Information and Analysis Content

The ER format should follow the general approach for information and analysis content for all ecology issues as described at the beginning of this section (see Section 4.6.1). The following is specific guidance for this issue:

- Document any communications with regulatory agencies (e.g., EPA or other water quality permitting agencies) and resource agencies (e.g., NMFS, U.S. Fish and Wildlife Service, State fish and wildlife agencies) regarding the issue of thermal impacts. Provide copies of any NPDES permits and Clean Water Act Section 316(a) variance determinations. If a valid NPDES permit relative to thermal discharges or a current Section 316(a) variance from State water temperature standards does not exist, discuss the outstanding issues.
- Briefly summarize any plant-specific thermal effluent studies, monitoring programs, or thermal effects or mortality studies and include locations, dates, objectives, methods, and results applicable to the license renewal application, as well as any data or data summaries available for NRC review. Estimate the number, by taxa, of fish and shellfish affected by and susceptible to the thermal effluent on a daily, monthly, and annual basis. Provide areal or volumetric estimates of thermally affected fish and shellfish habitat. Provide full documentation of analytical or modeling techniques used to assess effects. Describe these effects in terms of the commercial, recreational, and ecosystem services they would have provided.
- If aquatic resources have been monitored, provide an analysis of temporal and geographic trends in the data that might indicate whether fish and shellfish populations have increased, decreased, or remained stable during the current period of operation. Detail any relationships between patterns of thermal effects and trends in potentially affected populations. Discuss any mitigation measures in place to reduce thermal impacts (e.g., helper cooling towers, hatchery operations, habitat enhancements). Because entrainment, impingement, and thermal impacts affect field populations simultaneously, provide a single discussion, if possible, of the effects of these stressors on trends in the field data rather than discussing these three stressors individually.

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

This section applies to plants with cooling ponds or cooling towers using makeup water from a river. Table B-1 states, "Impacts on aquatic resources in stream communities affected by water use conflicts could be of moderate significance in some situations."

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 of the GEIS discusses surface water use conflicts for aquatic resources. 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

The ER format should follow the general approach for information and analysis content for all ecology issues as described at the beginning of this section (see Section 4.6.1).

4.6.4 Special Status Species and Habitats

Threatened, Endangered, and Protected Species and Essential Fish Habitat

Table B-1 states the following:

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

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 threatened or endangered species in accordance with Federal laws protecting wildlife, including but not limited to, the Endangered Species Act, and essential fish habitat in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.

Section 4.6.1.3 of the GEIS discusses this issue. Two Federal acts govern the protection of species and their habitat—the Endangered Species Act and, specific to aquatic species, the Magnuson-Stevens Act, which are both described in detail in Section 3.6 of this regulatory guide. Information needs specific to each act are outlined below.

Endangered Species Act

The applicant should determine whether the site and vicinity, including in-scope transmission lines, are within the range of listed species. If they are, the applicant should assess the extent to which license renewal, continued plant operation, and associated refurbishment activities are likely to jeopardize the continued existence of those listed species or result in the destruction or adverse modification of

critical habitat. If, in compiling information and assessing the effects of license renewal on threatened and endangered species, a need arises to consult with either the U.S. Fish and Wildlife Service or NMFS, the applicant should notify the NRC so that NRC staff can coordinate the communications.

Information and Analysis Content for the Endangered Species Act

In addition to the general information and analysis content for all ecology issues (see Section 4.6.1), the ER should include the species listed for protection and their critical or potential habitats among the biological entities to be analyzed for each ecological issue. Specifically, the ER should refer to any adverse impacts on listed and candidate threatened or endangered species or critical habitat found in the review of biologically related topics outlined in this regulatory guide. These include aquatic ecological communities, riparian ecological communities, entrainment and impingement of fish and shellfish, thermal effects from the heated effluent, surface water conflicts, or impacts of refurbishment and continued operation on terrestrial resources. The applicant should also describe any studies or monitoring programs that might provide relevant information about species listed for protection and their critical or potential habitats if the site is in the range of such species or their habitats. Any letters and communications with Federal, State, or local agencies about species and their critical habitat listed for protection should be referenced in the discussion, and copies should be included in an appendix to the ER.

Magnuson-Stevens Fishery Conservation and Management Act and Essential Fish Habitat

If license renewal might affect any essential fish habitat (EFH), the NRC staff will prepare, as part of the application review process, an EFH assessment that will describe how any such habitat might be affected. The applicant should provide sufficient information to help the NRC staff develop the EFH assessment.

Information and Analysis Content for Essential Fish Habitat

In addition to the general information and analysis content for all ecology issues (see Section 4.6.1), the applicant should include the following in the ER:

- Reference any EFH that may be found in water bodies that may be affected by plant operation. Reference any license renewal activities and modifications to plant operation that may adversely affect EFH. Reference letters and communications with NMFS and any resulting NMFS memoranda in the ER, and include any letters in the appendix to the ER.
- Describe the EFH, if any, that might be affected by plant operation. Include the EFH and the species for which it is designated among the biological entities to be analyzed for each aquatic issue. EFH regulations (50 CFR 600.10) give the following definitions: “‘waters’ include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; ‘substrate’ includes sediment, hard bottom, structures underlying the waters, and associated biological communities; ‘necessary’ means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and ‘spawning, breeding, feeding, or growth to maturity’ covers a species’ full life cycle.”

Other Acts

If license renewal might affect any species protected under other Federal species protection laws, including the Marine Mammal Protection Act, the Migratory Bird Treaty Act, and the Bald and Golden

Eagle Protection Act, the applicant should provide sufficient information to help the NRC staff develop an assessment of the impacts on those species.

Information and Analysis Content for Other Acts

In addition to the general information and analysis content for all ecology issues (see Section 4.6.1), the applicant should include the following in the ER:

- Reference any protected species that may be found on or in the vicinity of the site or associated in-scope transmission line ROWs and that may be affected by plant operations.
- Describe the protected species, if any, that might be affected by plant operation. Include those species among the biological entities to be analyzed for each terrestrial or aquatic issue, as appropriate.

4.7 Historic and Cultural Resources

The GEIS reviews the following Category 2 issue, which requires a plant-specific assessment.

Historic and Cultural Resources

Table B-1 states the following:

Continued operations and refurbishment associated with license renewal are expected to have no more than small impacts on historic and cultural resources located onsite and in the transmission line ROW because most impacts could be mitigated by avoiding those resources. The National Historic Preservation Act (NHPA) requires the Federal agency to consult with the State Historic Preservation Officer (SHPO) and appropriate Native American Tribes to determine the potential effects on historic properties and mitigation, if necessary.

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

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

Section 4.7 of the GEIS discusses historical and cultural resources. Section 106 of the NHPA of 1966, as amended (16 U.S.C. 470 et seq.), 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 National Register of Historic Places 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," defines the provisions for meeting Section 106 requirements. The following guidance instructs the applicant about the information and analysis required for the NRC to comply with Section 106 requirements in a manner that minimizes the potential need to consult with the Advisory Council on Historic Preservation, which could cause extensive delays in the environmental review. The applicant should also consider the effects of continued nuclear plant operations and maintenance activities on

properties that are not eligible for the National Register of Historic Places but could be considered by the SHPO 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 related to license renewal concerning continued nuclear plant operations, maintenance, and refurbishment that could affect onsite or offsite historic properties. Such activities include ground-disturbing activity, increases in traffic, and noise and visual intrusions.
- On a copy of the site map or, if appropriate, the site vicinity map included in Chapter 2 of the ER, identify the areas of potential effects for the plant site.
- Describe all historic properties. Properties can be identified by referring to 36 CFR Part 60, "National Register of Historic Places"; consulting the SHPO, local preservation officials, and nearby American Indian Tribal officials; and conducting field surveys.
- If historic properties are found in or near areas of potential effects, assess those effects. Use the criteria for assessment of adverse effects given in 36 CFR 800.5, "Assessment of Adverse Effects." Applicants should involve the SHPO, local historic preservation officials, and nearby American Indian Tribal officials (as necessary) in the assessment. The assessment should lead to one of three conclusions:
 - No effect—The undertaking will not affect historic properties.
 - No adverse effect—The undertaking will affect one or more historic properties, but the effect will not be harmful.
 - Adverse effect—The undertaking will harm one or more historic properties.
- If an adverse effect will or could occur, identify, in consultation with the SHPO, the NRC, and other interested parties, any mitigation measures that could be used to reduce, minimize, or avoid impact.

4.8 Socioeconomics

Socioeconomic impacts are evaluated in the GEIS and are considered to be 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 further assessment.

4.9 Human Health

The GEIS reviews the following human health-related Category 2 issues, which require a plant-specific assessment.

Microbiological Hazards to the Public (Plants with Cooling Ponds or Canals or Cooling Towers or Discharges to a River)

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

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

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

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

Nuclear plants that use cooling ponds, lakes, or canals or discharge into rivers have a potential to enhance the concentration of thermophilic microorganisms. These include the enteric pathogens *Salmonella* spp. and *Shigella* spp., as well as *Pseudomonas aeruginosa*, thermophilic fungi, *Legionella* spp. in unusually high concentrations, and the free-living amoebae of the genera *Naegleria* and *Acanthamoeba*. Of greatest concern is *Naegleria (N.)* sp., four species of which have been isolated. To date, only one species, *N. fowleri*, has been determined to be pathogenic in humans.

Information and Analysis Content

If the applicant can show that the nuclear plant does not use cooling ponds, lakes, or canals or does not discharge into rivers, the ER should note this fact, and further information or analysis need not be provided. If the plant does use cooling ponds, lakes, or canals or rivers to receive its thermal discharge, the applicant should provide the following information in the ER:

- If the State advises that tests should be conducted for concentration of *N. fowleri* 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 *N. fowleri* 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 GEIS discusses this issue, which concerns only the in-scope transmission lines. Sections 3.1.1 and 3.1.6.5 of the 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.¹¹ 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)(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

The GEIS reviews the following Category 2 issue, which requires a plant-specific assessment.

Severe Accidents

Table B-1 states the following:

11 See the *The National Electrical Safety Code®*, C2--2007 Edition, Institute of Electrical and Electronics Engineers, Inc., New York, 2007. Section 23 deals with clearances. Section 232 deals specifically with clearances between above-ground conductors and human activities, equipment, and structures.

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

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

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

Section 4.9.1.2 and Appendix E to the GEIS discuss severe accident mitigation alternatives (SAMAs). The analyses performed for Chapter 5, "Environmental Consequences of Accidents," in the 1996 GEIS represent adequate, plant-specific estimates of the environmental impacts of severe accidents. However, the Commission determined that a site-specific consideration of SAMAs will be required at the time of license renewal in a final environmental impact statement, final environmental assessment, or related supplement unless previously considered. If SAMAs have been previously considered, the applicant should provide the relevant citation in the ER. If not, the applicant should include the information described below.

Information and Analysis Content

The identification of possible SAMAs and evaluation of their merits should use the information and analyses from the most recent risk models that contain modeling of all plant changes implemented up to the date of the model (freeze date), contain use failure and unavailability data to the same date, and resolve industry peer review comments on a previous revision of the model. The discussion of SAMAs should also include insights from the individual plant examination for severe accident vulnerabilities and the plant-specific individual plant examination of external events for severe accident vulnerabilities (e.g., earthquakes, fire, winds). Major changes to the plant, such as power uprate or steam generator replacement, may be planned or may have occurred since the model freeze date. If the Level 1 or Level 2 probabilistic risk assessment model used for the SAMA analysis does not address a major plant change or planned major plant change, a sensitivity analysis should be performed to support discussion of the impact of the change on the SAMA analysis results.

In preparing the SAMA analyses, applicants may be guided by analyses performed for previous applications for renewal of operating licenses, as documented in supplements to the GEIS. In structuring the analysis, the applicant should consider the methodology presented in NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," issued January 1997, and the guidance provided in NEI 05-01, Revision A, "Severe Accident Mitigation Alternatives (SAMA) Analysis, Guidance Document," issued November 2005.

The applicant should present the results of the following analytical steps in the ER and describe the methodology or analytical process used:

1. Based on the plant-specific risk study, offsite consequence analysis, and supplementary analyses, identify and characterize the leading contributors to core damage frequency and offsite risk (e.g., population dose). The frequency of and contributors to core damage frequency and large release frequency are generally available from the plant-specific risk study. Development of offsite risk information may require additional site-specific analyses if the existing risk study does not include an assessment of offsite consequences.

2. From the external event analyses, provide estimates of the incremental contribution to core damage frequency and population dose from external events.
3. Identify practical physical plant modifications and plant procedural and administrative changes that can reduce severe accident dose consequence risk, considering both internal and external events. For each modification or change, estimate the approximate reduction in risk.
4. Estimate the value of the reduction in risk. Value is usually calculated for public health, occupational health, offsite property, and onsite property. Chapter 5 of NUREG/BR-0184 provides a detailed discussion of value calculation.
5. Estimate the approximate cost of each modification and procedural and administrative change found to reduce the dose consequence risk of severe accidents. Ensure that SAMAs that are subsumed or combined do not have a lower cost of implementation than the SAMA actually evaluated. Potential SAMAs that are not expected to be cost beneficial, even when uncertainties in the analysis are considered, may be screened out based on a bounding analysis.
6. Perform a more detailed value-impact analysis for the remaining SAMAs to identify any plant modifications and procedural and administrative changes that may be cost effective (see Chapter 5 of NUREG/BR-0184).
7. List plant modifications and procedural changes (if any) that have been or will be implemented to reduce the severe accident dose consequence risk or that will be further evaluated for possible implementation.
8. Provide citations of sources of data, information, and computer codes used to assess impacts, and provide a list of references that cites which revisions (if any) are used.

4.10 Environmental Justice

The GEIS reviews the following Category 2 issue, which requires a plant-specific assessment.

Minority and Low-Income Populations

Table B-1 states the following:

Impacts to minority and low-income populations and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in plant-specific reviews. See NRC Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040, August 24, 2004).

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) residing in the immediate vicinity of the plant that could be affected by the renewal of the plant's operating license, including any planned refurbishment activities, and ongoing and future plant operations.

On February 11, 1994, the President signed Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," which directs all Federal

agencies to consider environmental justice in their programs, policies, and activities. The Executive Order describes environmental justice as “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.” The 1996 GEIS did not consider environmental justice because guidance on how to conduct environmental justice reviews had not been issued.

On December 10, 1997, CEQ issued “Environmental Justice: Guidance under the National Environmental Policy Act.” CEQ developed this guidance to “further assist Federal agencies with their National Environmental Policy Act (NEPA) procedures.” Neither Executive Order 12898 nor the CEQ guidance is binding on the NRC because it is an independent regulatory agency; however, as a matter of policy (see below), 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 December 10, 1997, guidance:

Disproportionately High and Adverse Human Health Effects—Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. 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 for a minority or low-income population is significant (as employed by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group.

Disproportionately High and Adverse Environmental Effects—A disproportionately high environmental impact that is significant (as employed by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered.

On August 24, 2004, the Commission issued its “Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions” (69 FR 52040), 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 in the vicinity of the plant that may be affected by license renewal and any concerns and potential environmental impacts that may affect these populations. This includes identifying the geographic areas of comparison, as well as the significance of any concerns and potential environmental impacts and whether they would be disproportionately high and adverse when compared to impacts on the general population. If they would be disproportionately high and adverse, the review should consider the mitigation measures available to reduce or eliminate these impacts and the mitigation measures that will

be implemented. 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 and low-income populations and will report the results of this review in the SEIS. The review will be based on information provided in the ER and developed during the scoping process.

Information and Analysis Content

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

- Based on information about minority and low-income populations and communities residing in the immediate vicinity of the plant site (as presented in Section 3.10 of this guide that addresses ER Section 3.10), identify potential impacts and any concerns these populations and communities may have about the continued operation of the nuclear plant. Also discuss the potential for disproportionately high and adverse human health and environmental impacts 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 in the vicinity of the 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, berries, and other plant material) conducted by minority and low-income individuals in the vicinity of the plant.
- To the extent that information is available, provide any information about current or past wildlife sampling and testing for radioactivity of game animals such as deer, squirrel, turkey, pheasant, duck, and other game birds and animals that may have been conducted in the vicinity of plant.
- If it is determined that plant operations and other associated license renewal activities could affect minority and/or low-income populations, describe any mitigation measures that could be implemented.

4.11 Waste Management

Impacts associated with waste management activities are evaluated in the GEIS and are considered to be 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 further assessment.

4.12 Cumulative Impacts

The GEIS reviews the following Category 2 issue, which requires a plant-specific assessment:

Cumulative Impacts

Table B-1 states the following:

Cumulative impacts of continued operations and refurbishment associated with license renewal must be considered on a plant-specific basis. Impacts would depend on regional

resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.

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

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

CEQ defines cumulative impact (also known as cumulative effect) in 40 CFR 1508.7 as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” Cumulative impact analyses should consider new and continuing 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 of cumulative impacts should focus on the resources that could be affected by the incremental impacts of continued plant operations. CEQ discusses the assessment of cumulative effects in detail in its 1997 publication, “Considering Cumulative Effects Under the National Environmental Policy Act.” EPA presents a number of 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.

On the basis of the guidance provided by CEQ, a cumulative impact analysis in the ER should include the following considerations:

- The geographic scope (i.e., regions of influence): The regions of influence encompass the areas of effect and the distances at which impacts associated with license renewal may occur. Geographic boundaries vary by resource area and the distances over which an impact may occur (e.g., the evaluation of impacts on air quality may have a greater regional extent than that of impacts on cultural resources).
- The timeframe for the analysis: The timeframe incorporates the sum of the effects of renewal in combination with past, present, and future actions because impacts may accumulate or develop over time. The reasonably foreseeable timeframe for future actions is 20 years (based on the typical license renewal term) from the time the license renewal is granted. Past and present actions include all actions up to and including the time of the license renewal application. Future actions are those that are “reasonably foreseeable,” that is, they are ongoing (and will continue into the future), are funded for future implementation, are included in firm, near-term plans, or generally have a high probability of being implemented. The baseline assessment presented in the affected environment sections for each resource area (Chapter 3 of the ER) generally accounts for past and present actions. The direct and indirect impact analyses presented in Chapter 4 of the ER address the incremental impacts of license renewal. These analyses are carried forward to the cumulative impact analysis, which expands the analysis to consider other past, present, and future actions. Section 4.13 of the GEIS provides examples of the types of other actions that the analysis should consider.
- Factors potentially affecting each past, present, or reasonably foreseeable future action or activity: Both the license renewal and other actions (related and nonrelated, including trends such as

global climate change) will generate factors that could contribute to cumulative impacts. Because cumulative impacts are additive, the analysis of cumulative impacts should concentrate only on potentially affected resources. The scope of the analysis is on resources that are likely to experience impacts from other past, present, and reasonably foreseeable actions in addition to the contribution from ongoing operations, maintenance, and refurbishment activities at the nuclear plant during the license renewal term.

For some resource areas (e.g., water and aquatic resources), the contributions of ongoing actions within a region to cumulative impacts are regulated and monitored through a permitting process (e.g., NPDES) under State or Federal authority. In these cases, it may be assumed that cumulative impacts are managed as long as these actions (e.g., facility operations) are in compliance with their respective permits. If, however, the cumulative impacts analysis indicates that a moderate to large contribution to cumulative impacts would occur as a result of license renewal, the ER should identify mitigation measures to reduce and/or avoid any adverse effects. Recent license renewal environmental reviews have found cumulative impacts to be small for most resources in the region surrounding a nuclear power plant with some exceptions. These exceptions include cumulative impacts on terrestrial resources at the Susquehanna plant in Pennsylvania (ranging from moderate to large) and aquatic resources at the Oyster Creek Plant in New Jersey (ranging from small to moderate).

4.13 Impacts Common to All Alternatives: Uranium Fuel Cycle

Impacts associated with the uranium fuel cycle are evaluated in the GEIS and are considered to be generic (the same or similar at all plants), or Category 1, except for the issue of “Offsite radiological impacts of spent nuclear fuel and high-level waste disposal.” The categorization for this issue was changed from Category 1 to uncategorized and requires no response from applicants in the ER. For Category 1 issues, the applicant should discuss any new and significant information in the ER, if applicable; otherwise, uranium fuel cycle impacts do not need further assessment. Transportation impacts are a Category 1 issue, and the impacts are small as long as the fuel used 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). Any potential applicant for license renewal that uses or plans to seek approval (in the reasonably foreseeable future) to use nuclear fuel enriched beyond 5-percent uranium-235 or operates at an average burnup for the peak rod beyond 62,000 MWd/MTU should request early guidance from the NRC staff on how to handle this issue in the ER.

4.14 Termination of Nuclear Power Plant Operations and Decommissioning

Impacts associated with the termination of plant operations and decommissioning are evaluated in the GEIS and are considered to be 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 plant operations and decommissioning impacts do not need further assessment.

Chapter 5 Assessment of New and Significant Information

Section A.2 of this regulatory guide discusses the regulatory requirement to report new and significant information. While new and significant information can be identified from the scoping process, during site visits, and from public comments on the draft SEIS, it is also very important for the applicant to identify new and significant information prior to the beginning of the license renewal 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 action than previously considered in the GEIS, such as an environmental impact finding different from that codified in Table B-1 (see Section A.2 of this regulatory guide for a definition of “new

and significant information”) and if so, describe those differences and assess any relevant environmental impacts. Applicants should 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 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, local, and Tribal environmental, natural resource, permitting, and land use agencies. If the applicant determines that no new and significant information exists, the applicant should state this determination in the ER.
- Describe any new and significant information and any environmental impacts.
- For each adverse impact, describe mitigation measures that were considered and those that could be implemented.

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

Chapter 6 Summary of License Renewal Impacts and Mitigating Actions

6.1 License Renewal Impacts

This section should summarize in a table the environmental impacts of continued plant operations during the license renewal term. The presentation should be organized by environmental resource area, such as the subject areas presented in Table B-1 in Appendix B to Subpart A of 10 CFR Part 51.

6.2 Mitigation

This section should summarize in tabular form any mitigation measures considered for implementation in the ER.

6.3 Unavoidable Adverse Impacts

This section 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

This section 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 during the license renewal term and additional waste materials generated by continued plant operations. 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

This section 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 plant (including any extension of operating life through license renewal), and “long-term” indicates the period after the licensed operating life ends and continuing for as long as the plant could have discernible impacts. 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 mankind.

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) 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 environmental impact statement. These requirements are consistent with the CEQ regulations implementing NEPA (40 CFR 1502.14), which require that an environmental impact statement do the following:¹²

- Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives that were eliminated from detailed study, briefly discuss the reasons for their elimination.
- Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate the comparative merits of the alternatives.
- Include reasonable alternatives not within the jurisdiction of the lead agency.
- Include the alternative of no action.
- 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.

A reasonable 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. In deciding whether or not to renew the operating license, the NRC will consider the environmental impacts of replacement power 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 Replacement Power Alternatives

Alternatives Considered

Each replacement power alternative should meet the purpose and need for the proposed action. The purpose and need adopted by the NRC, as stated in the GEIS and in Section 1 of this guide that addresses ER Chapter 1, are to meet future system generating needs. Alternatives that meet the stated purpose and need are (1) to build new generating capacity (i.e., construct and operate a new fossil fuel or renewable energy power plant), (2) to purchase power, or (3) to reduce power requirements through demand reductions and conservation or energy efficiency measures. 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.

12 The CEQ publication, “Forty Most Asked Questions Concerning CEQ’s National Environmental Policy Act Regulations,” dated March 23, 1981, and amended April 25, 1986 (46 FR 18026 and 51 FR 15618, respectively), provides additional guidance on alternatives.

In this section of the ER, the applicant should describe the process used to identify and select alternatives to the proposed action (see also Section 2.6 of this guide). The applicant should describe all of the replacement power alternatives considered and indicate which alternatives were evaluated in detail. In addition, the applicant should explain why it eliminated certain alternatives from detailed study. The applicant should also discuss the extent to which alternatives have been considered by State, utility, or, where applicable, Federal authorities (e.g., public service commissions; environmental, natural resource, or energy agencies; or other groups vested with energy-planning authority, depending on existing energy regulatory structures) and how such considerations relate to the applicant's evaluation. This discussion should include any existing State regulations that promote, enhance, prohibit, or challenge particular alternatives.

Environmental Impacts of Replacement Power Alternatives

This section of the ER should describe the impacts of the replacement power alternatives identified for detailed study. The impacts should be described in sufficient detail and in similar format to the proposed action so that the NRC staff reviewers can compare the effects of the replacement power alternatives with the effects of continued plant operations. Impact analyses should consider 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 impacts assessment should include direct, indirect, and cumulative impacts. For each alternative, the analysis should identify and, to the extent possible, quantify 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 (whenever possible to locate an alternative at the existing plant site), or at least 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. Chapter 4 of the 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 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 the process they used to identify and select alternatives for reducing adverse impacts (see also Section 2.6 of this guide). Applicants should describe all of the alternatives considered and indicate which alternatives they evaluated in detail. Typical alternatives considered in this section 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

This section should describe the impacts of the alternatives for reducing adverse effects identified for detailed study. Impacts should be described in sufficient detail in the ER and in similar format to the proposed action so that the NRC staff reviewers can compare the effects of the alternatives with the effects of continued plant operations. Impact analyses should consider 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 impacts analyses should include direct, indirect, and cumulative impacts. For each alternative, the analysis should identify and, to the extent possible, quantify unavoidable adverse impacts, irreversible and irretrievable resource commitments, and tradeoffs between short-term use and the long-term productivity of the environment. The applicant should analyze each alternative on a site-specific basis and in proportion to its significance.

7.3 No-Action Alternative

The applicant must include an analysis of the no-action alternative in its ER. For license renewal, the no-action alternative is a scenario in which the NRC takes no action, which results in the applicant's operating license expiring at the end of the current licensing period. The applicant would continue to operate the plant until the expiration of the current license. At or before license expiration, the applicant could decide to terminate plant operations and initiate decommissioning activities.

Decommissioning is not a consequence of the no-action alternative because it would occur at some point in time at the end of the plant's operating life, whenever the applicant decides that the power plant is no longer economically viable and terminates plant operations. Decommissioning may begin at the end of (or before the end of) the current operating license and may continue until well after the license expires. As discussed in the GEIS (Section 12.4.2.1), decommissioning will make no difference in impact regardless of when decommissioning commences.

The impacts of the no-action alternative are the impacts from terminating plant operations rather than from decommissioning. The analysis should consider direct, indirect, and cumulative impacts from the termination of plant operations. The level of detail of the analyses should be commensurate with the significance of the impacts. The applicant may summarize and incorporate by reference material from the 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 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 agencies (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 power alternatives discussed in Section 7.1. The range of impacts for the no-action alternative should address the impacts associated with replacement power or other possible measures to address the loss of the plant's generating capacity.

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

This section should compare the impacts of the proposed action, reasonable replacement power alternatives to the proposed action, and the no-action alternative to define the issues and provide a clear basis for the NRC to "...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," as stipulated in 10 CFR 51.95(c)(4). The applicant may present this comparison in any of several formats. Often the comparison is presented in a table, such as Tables 2.4-1 through 2.4-5 in the GEIS. The comparison should emphasize the more significant impacts of each alternative.

Chapter 9 Status of Compliance

Pursuant to 10 CFR 51.45(d), an applicant must 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 to Volume 2 of the GEIS presents a brief discussion of Federal and State laws, regulations, and other requirements that may apply to, or be triggered by, the renewal and continued operation of NRC-licensed nuclear power plants. Appendix F also provides information about environmental laws and regulations applicable to license renewal that would be identified in Chapter 3, “Affected Environment,” in an SEIS. 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:

1. 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, or
2. 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 to Volume 2 of the 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 plant site.

C. IMPLEMENTATION

The purpose of this section is to provide information on how applicants for renewal of power reactor operating licenses under 10 CFR Part 54 may use this regulatory guide to comply with applicable provisions of 10 CFR Part 51. This section also provides information on the NRC’s plans for using this regulatory guide to comply with the NRC’s obligations under the National Environmental Policy Act (NEPA) and to implement 10 CFR Part 51. In addition, this section describes how the NRC staff complies with 10 CFR 50.109, “Backfitting” and any applicable finality provisions in 10 CFR Part 52 “Licenses, Certifications, and Approvals for Nuclear Power Plants.”

Use by Applicants

Applicants for renewal of power reactor operating licenses under 10 CFR Part 54 may voluntarily use the guidance in this document to develop the environmental report required under 10 CFR 51.53(c). Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations.

Use by Licensees

This regulatory guide does not provide guidance to any holder of a renewed license under Part 54.

Use by NRC Staff

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this regulatory guide on current holders of operating licenses who have not submitted applications for renewal under Part 54. This regulatory guide provides guidance to applicants for renewed licenses issued under Part 54, and does not provide guidance to any holder of a renewed license issued under Part 54. The NRC staff does not intend to use the guidance as part of its consideration of the environmental impacts associated with any subsequent amendment of that nuclear power plant's design.

REFERENCES

U.S. Nuclear Regulatory Commission Documents¹³

NUREG-Series Reports

NUREG-1409, "Backfitting Guidelines," July 1990. (ADAMS Accession No. ML032230247)

NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Vols. 1 and 2, May 1996. (Vol. 1 ADAMS Accession No. ML040690705, Vol. 2 ML040690738)

NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Addendum 1, "Section 6.3, Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants," August 1999. (ADAMS Accession No. ML040690720)

NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Vols. 1, 2 and 3, Revision 1, June 2013. (ADAMS Accession No. ML13106A241, ML13106A242, ML13106A244)

13 Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public Web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. The documents can also be viewed on-line or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone (301) 415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail pdr.resource@nrc.gov.

NUREG-1555, Supplement 1, “Standard Review Plans for Environmental Reviews of Nuclear Power Plants, Supplement 1: Operating License Renewal,” Revision 1, May 2013. (ADAMS Accession No. ML13106A246)

NUREG/BR-0184, “Regulatory Analysis Technical Evaluation Handbook,” October 2010. (ADAMS Accession No. ML050190193)

Regulatory Guides

Regulatory Guide 4.2, Supplement 1, “Preparation of Supplemental Environmental Reports for Applicants to Renew Nuclear Power Plant Operating Licenses.”

Miscellaneous NRC Documents

Management Directive 8.4, “Management of Facility-Specific Backfitting and Information Collection,” October 2004. (ADAMS Accession No. ML050110156)

Regulatory Analysis, “Final Rule Revisions to 10 CFR Part 51, Environmental Review for Renewal of Nuclear Power Plant Operating Licenses,” April 2012. (ADAMS Accession No. ML110760321)

Federal Laws and Regulations¹⁴

10 CFR Part 2, “Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders.”

10 CFR Part 20, “Standards for Protection Against Radiation.”

10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities.”

10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.”

10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.”

10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.”

36 CFR Part 60, “National Register of Historic Places.”

36 CFR Part 800, “Protection of Historic Properties.”

40 CFR Part 50, “National Primary and Secondary Ambient Air Quality Standards.”

40 CFR Part 93, “Determining Conformity of Federal Actions to State or Federal Implementation Plans.”

40 CFR Part 1502, “Environmental Impact Statement.”

40 CFR Part 1506, “Other Requirements of NEPA.”

14 Federal Register Notices (FRN) and other publicly available Federal Government documents may be viewed or electronically downloaded for free from the U.S. Government Printing Office at <http://www.gpo.gov/fdsys/> by contacting the Customer Contact Center at 710 North Capitol Street N.W., Washington, DC; telephone 866-512-1800; or by e-mail at ContactCenter@GPO.Gov.

40 CFR Part 1508, “Terminology and Index.”

50 CFR Part 402, “Interagency Cooperation—Endangered Species Act of 1973, as Amended.”

50 CFR Part 600, “Magnuson-Stevens Act Provisions.”

Bald and Golden Eagle Protection Act of 1972, as amended, 16 U.S.C. 668a-d.

Clean Air Act of 1970 (CAA), as amended, 42 U.S.C. 7401 et seq.

Clean Water Act of 1972, as amended, 33 U.S.C. 1251 et seq.

Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Executive Order 12898, “Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations,” 59 FR 7629, February 16, 1994.

Farmland Protection Policy Act (FPPA) of 1981, as amended, 7 U.S.C. 4201 et seq.

Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended, 16 U.S.C. 1801 et seq.

Marine Mammal Protection Act of 1972, as amended, 16 U.S.C. 1361 et seq.

Migratory Bird Treaty Act of 1918, as amended, 16 U.S.C. 703-712.

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

National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Resource Conservation and Recovery Act of 1976, as amended, 42 U.S.C. 6901 et seq.

Federal Register Notices¹⁵

46 FR 18026, Council on Environmental Quality, “Forty Most Asked Questions Concerning CEQ’s National Environmental Policy Act Regulations,” *Federal Register*, Volume 46, p. 18026, March 23, 1981. Amended 51 FR 15618, April 25, 1986.

58 FR 63214, U.S. Environmental Protection Agency, “Final Rule for Determining Conformity of General Federal Actions to State or Federal Implementation Plans,” *Federal Register*, Volume 58, p. 63214, November 30, 1993.

61 FR 28467, U.S. Nuclear Regulatory Commission, “Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule,” *Federal Register*, Volume 61, p. 28467, June 5, 1996.

¹⁵ Printed copies of Federal Register notices are available for a fee from the U.S. Government Printing Office, 732 N Capitol Street, NW Washington, DC 20401, telephone (866) 521-1800, or they may be downloaded for free from the Government Printing Office Web site: <http://www.gpo.gov/fdsys/>.

61 FR 66537, U.S. Nuclear Regulatory Commission, “Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule,” *Federal Register*, Volume 61, p. 66537, December 18, 1996.

64 FR 48496, U.S. Nuclear Regulatory Commission, “Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule,” *Federal Register*, Volume 64, p. 48496, September 3, 1999.

69 FR 52040, U.S. Nuclear Regulatory Commission, “Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions; Final Policy Statement,” *Federal Register*, Volume 69, p. 52040, August 24, 2004.

75 FR 17254, U.S. Environmental Protection Agency, “Revisions to the General Conformity Regulations; Final Rule,” *Federal Register*, Volume 75, p. 17254, April 5, 2010.

78 FR 37325, U.S. Nuclear Regulatory Commission, “License Renewal of Nuclear Power Plants; Generic Environmental Impact Statement and Standard Review Plans for Environmental Reviews,” *Federal Register*, Volume 78, p. 37325 – 37326, June 20, 2013.

Other Documents

Council on Environmental Quality (CEQ), “Considering Cumulative Effects under the National Environmental Policy Act,” Office of the President, Washington, DC, 1997. Available at: <http://ceq.hss.doe.gov/nepa/ccenepa/ccenepa.htm>. Accessed January 28, 2013.

Council on Environmental Quality (CEQ), “Environmental Justice: Guidance under the National Environmental Policy Act”, Office of the President, Washington, DC, December 10, 1997. Available at: <http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf>. Accessed January 28, 2013.

Daily, G.C., S. Alexander, P.R. Ehrlich, J. Lubchenco, P.A. Matson, H.A. Mooney, S. Postel, S.H. Schneider, D. Tilman, and G.M. Woodwell, “Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems,” *Issues in Ecology*, 2:1–16, 1997. Available at http://www.esa.org/science_resources/issues/FileEnglish/issue2.pdf. Accessed January 28, 2013.

Institute of Electrical and Electronic Engineers, Inc. (IEEE), “National Electrical Safety Code,” C2, 2007, New York, NY.¹⁶

Lowrance, R.R., S. McIntyre, and C. Lance, “Erosion and Deposition in a Field/Forest System Estimated Using Cesium-137 Activity,” *Journal of Soil and Water Conservation*, 43(2):195–199, 1988. (Cited in EPA 1993.) Available at <http://www.jswconline.org/content/43/2/195.full.pdf+html>. Accessed January 28, 2013.

Mitsch, W.J., and J.G. Gosselink, *Wetlands*, Van Nostrand Reinhold Co., New York, NY, 1986. (Cited in EPA 1993.) Available at <http://www.alibris.com/search/books/qwork/7172347/used/Wetlands>. Accessed January 28, 2013.

16 Copies of Institute of Electrical and Electronics Engineers (IEEE) documents may be purchased from the Institute of Electrical and Electronics Engineers Service Center, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855 or through the IEEE’s public Web site at http://www.ieee.org/publications_standards/index.html.

National Marine Fisheries Service (NMFS), “Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies,” EFH Federal Agency Primer, Northeast Regional Office, Gloucester, MA, December 1998. Available at: <http://www.nero.noaa.gov/hcd/finprim.pdf>. Accessed January 28, 2013.

National Research Council, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*, The National Academies Press, Washington, DC, 2004. Available at http://www.nap.edu/catalog.php?record_id=11139. Accessed January 28, 2013.

Natural Resources Conservation Service (NRCS), “Web Soil Survey,” U.S. Department of Agriculture, National Cooperative Soil Survey, 2011. Available at: <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>. Accessed January 28, 2013.

Nuclear Energy Institute (NEI), “Severe Accident Mitigation Alternatives (SAMA) Analysis, Guidance Document,” NEI 05-01, Revision A, Washington, DC, November 2005. (ADAMS Accession No. ML060530203)

Nuclear Energy Institute (NEI), “Industry Ground Water Protection Initiative—Final Guidance Document,” NEI 07-07, Washington, DC, August 2007. (ADAMS Accession No. ML072600290)

U.S. Environmental Protection Agency (EPA), “Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters,” Chapter 7, “Management Measures for Wetlands, Riparian Areas, and Vegetated Treatment Systems, ‘Glossary,’” EPA/840/B-92/002, Office of Wetlands, Oceans & Watersheds, January 1993. Available at: <http://www.epa.gov/owow/nps/MMGI/>. Accessed January 28, 2013.

U.S. Environmental Protection Agency (EPA), “Compilation of Air Pollutant Emission Factors,” Volume 1: “Stationary Point and Area Sources,” AP 42, Fifth Edition, Office of Air Quality Planning and Standards, Research Triangle Park, NC, January 1995. Available at: <http://www.epa.gov/ttn/chief/ap42/>. Accessed January 28, 2013.

U.S. Environmental Protection Agency (EPA), “Guidelines for Ecological Risk Assessment,” EPA/630/R-95/002F, Risk Assessment Forum, Washington, DC, April 1998. Available at: <http://www.epa.gov/raf/publications/guidelines-ecological-risk-assessment.htm>. Accessed January 28, 2013.

U.S. Environmental Protection Agency (EPA), “Consideration of Cumulative Impacts in EPA Review of NEPA Documents,” EPA 315-R-99-002, Office of Federal Activities, May 1999. Available at: <http://www.epa.gov/compliance/resources/policies/nepa/>. Accessed January 28, 2013.

U.S. Geological Survey (USGS), “USGS NLCD Land Cover Class Definitions,” USGS Earth Resources Observation Data Center, Land Cover Institute, Sioux Falls, SD, 2010. Available at: <http://landcover.usgs.gov/classes.php>. Accessed January 28, 2013.

Vaughan, R., *Endangered Species Act Handbook*, Government Institutes, Inc., Rockville, MD, 1994. Available at <http://www.amazon.com/Endangered-Species-Act-Handbook-Vaughan/dp/0865873925>. Accessed January 28, 2013.