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REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

SUPPLEMENT 1 TO REGULATORY GUIDE 4.2

(Drafts were issued as DG-4002 and DG-4005)

PREPARATION OF SUPPLEMENTAL ENVIRONMENTAL REPORTS FOR APPLICATIONS TO RENEW NUCLEAR POWER PLANT OPERATING LICENSES

Regulatory guides are issued to describe and make available to the public such information as methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, techniques used by the staff in evaluating specific problems or postulated accidents, and data needed by the NRC staff in its review of applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Written comments may be submitted to the Rules and Directives Branch, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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A. INTRODUCTION

This regulatory guide provides guidance on the format and content of an environmental report (ER) to be submitted as part of an application for the renewal of a nuclear power plant operating license submitted pursuant to 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." This guide supplements Revision 2 of Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Stations," July 1976.¹ Regulatory Guide 4.2 provides guidance on the information that should be included in a site approval application to address the environmental impacts of construction and operation of the proposed plant and associated facilities. Use of this guide will help ensure the completeness of the information provided, will assist the NRC staff and others in locating the information, and will shorten the review process. Conformance with the suggested format, however, is not required and is provided for guidance only.

This regulatory guide explains how the provisions for the environmental review for renewal of nuclear power plant operating licenses, found in NRC's 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," may be met. Part 51 implements section 102(2) of the National Environmental Policy Act of 1969 (NEPA), as amended. The license renewal provisions of Part 51 were promulgated on December 18, 1996, in 61 FR 66537, and became effective on January 17, 1997. The rule was developed with the intent of improving the efficiency of the environmental review process for renewal of nuclear power plant operating licenses. These provisions codify the analyses conducted for and reported in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," May 1996.²

The rule was amended on September 3, 1999 (64 FR 48495), to add more current information to the generic findings on the environmental impacts that are due to transportation of fuel and waste to and from a single nuclear power plant. The analysis supporting the amendment is provided in NUREG-1437, Vol. 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," August 1999. Also, the amendment added the requirement to address local traffic impacts attributable to continued operation of the nuclear power plant during the license renewal term. This requirement was noted in NUREG-1437, but inadvertently omitted from the 1996 rule at the time of its publication. Occasionally, additional amendments to the rule may be made in the

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² Copies are available at current rates from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328 (telephone (202)512-2249); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

future. The staff anticipates that the rule amendments will be supported by addenda to NUREG-1437 and revisions to this regulatory guide. Applicants should become familiar with the content of NUREG-1437 as the ER is developed.

NUREG-1437 assesses 92 environmental issues; the analyses reported in NUREG-1437, including Addendum 1, found 69 of these issues to be adequately addressed for all plants for which the issue is relevant. These issues are identified as Category 1 issues, and additional analysis is not required in a plant-specific review. Of the remaining 23 issues, there are 21 Category 2 issues, which require additional plant-specific analyses. Two issues (effects of electromagnetic fields and environmental justice) are not categorized and will be addressed by the NRC. An applicant should provide adequate information to support an environmental justice review by the NRC (see Section 4.22 of this guide).

ENVIRONMENTAL REVIEW PROCESS

After receiving an applicant's Environmental Report—Operating License Renewal Stage (ER), the NRC staff will perform an acceptance review to determine whether the information is sufficiently complete to begin the NEPA review. After reviewing and independently assessing the analyses provided in the ER, the NRC will prepare a supplemental environmental impact statement (SEIS) that incorporates and supplements the analyses presented in NUREG-1437. The NRC staff review and the NRC staff preparation of the SEIS will be guided by NUREG-1555, Supplement 1, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Operating License Renewal, March 2000."³ The SEIS is the NRC's independent analysis of the environmental impacts of the proposed action (the renewal of the operating license of the specific nuclear power plant) and the alternatives to the proposed action. Within the context of the NEPA review, the SEIS will contain the recommendation of the NRC staff regarding the proposed action. These recommendations, along with the findings from the 10 CFR Part 54 review, will be considered in the NRC record of decision.

The NRC NEPA review process for an environmental impact statement involves the following actions that are required of the NRC by 10 CFR Part 51.

- Publish a notice of intent to prepare an SEIS in the *Federal Register* (see 10 CFR 51.27 and 51.95(c)) and send copies of the notice to appropriate Federal, State, and local agencies; affected Native American tribal agencies; State, regional, and metropolitan clearinghouses; and any interested persons upon request. The notice is to explain the scoping process, state the locations of copies of the ER that are available for public inspection, and invite public participation in the scoping process.

³ NUREG-1555 is available in hard copy and compact disk (CD) versions for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343. NUREG-1555 is on the NRC Web Site at <http://www.nrc.gov/NRC/NUREGS/indexnum.html>. Additionally, publicly available records will be accessible electronically from the ADAMS Public Library component on the NRC Web site, <http://www.nrc.gov> (the Electronic Reading Room).

- Conduct scoping (see 10 CFR 51.28 and 51.29). The scoping process includes identifying and inviting appropriate agencies, groups, and persons to participate in the process. With respect to license renewal, the focus of scoping is to allow other parties to raise environmental issues that they believe are significant and yet are not addressed or not adequately addressed in the ER. Parties may raise issues at the public scoping meeting, which the NRC staff routinely holds in the vicinity of the plant, and in written comments. The scoping process also routinely includes a staff site visit to the plant and communication with local, regional, and State officials and representatives of interested or knowledgeable organizations. As a result of scoping, the staff may request additional information from the applicant.
- Prepare a draft SEIS (see 10 CFR 51.70 and 51.95(c)). In developing the draft SEIS, the NRC staff will independently evaluate the information provided by the applicant and others, as well as information independently identified by the staff.
- Distribute the draft SEIS for comment (see 10 CFR 51.73). A notice of the SEIS's availability will be published in the *Federal Register* and copies of the draft SEIS will be distributed to the Environmental Protection Agency (EPA); other appropriate Federal agencies; affected Native American tribal agencies; appropriate State, regional, and local agencies; organizations and individuals who have expressed interest in the review, and any other parties requesting a copy.
- Prepare a final SEIS (see 10 CFR 51.95(c)). In developing the final SEIS, the NRC staff will consider comments received on the draft, prepare responses, and modify the SEIS as warranted. The staff will determine whether such comments identify new and significant information not considered in NUREG-1437 nor addressed in the applicant's ER. After considering the environmental impacts associated with license renewal and with the alternatives to license renewal, the staff will reach a conclusion as to whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. A notice of the availability of the final SEIS will be published in the *Federal Register*.
- Hold a hearing on the license renewal application if the Commission or the designated licensing board determines that it is in the public interest. In accordance with 10 CFR 2.105(a)(10), a notice of opportunity for hearing will be issued 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.)
- Provide a Record of Decision (see 10 CFR 51.103). The Record of Decision will discuss the alternatives considered in the SEIS, the measures taken to minimize environmental harm, 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 decision makers would be unreasonable. The Commission's final decision on the application is published in the *Federal Register*.

GENERAL GUIDANCE TO APPLICANTS

Use of Regulatory Guides

Regulatory guides are issued to describe to the public methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, to explain techniques used by the staff in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required.

Environmental Reports - General Guidance

An ER should contain sufficient information to support analyses and findings. While other documents (e.g., the original ER or Safety Analysis Report (SAR)) may be referenced, information used in analyses should be summarized in the ER. In preparing the ER, the applicant should be guided by the general requirements set out in 10 CFR 51.45 and 51.55 in addition to the provisions of 10 CFR 51.53(c) specific to operating license renewal.

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." The ER should list those Category 1 issues that apply to the plant and identify the Category 1 issues that do not apply to the plant. The findings in NUREG-1437 for the applicable Category 1 issue are incorporated by reference in the ER.

New and Significant Information

According to 10 CFR 51.53(c)(3)(iv), "The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." New and significant information is (1) information that identifies a significant environmental issue that was not considered in NUREG-1437 and, consequently, not codified in Appendix B to Subpart A of 10 CFR Part 51, or (2) information that was not considered in the analyses summarized in NUREG-1437 and that leads to an impact finding different from that codified in 10 CFR Part 51. An applicant should state in the ER whether it is or is not aware of any new and significant information and explain any actions that were taken to identify new information and evaluate its significance. This information will assist the staff in fulfilling its responsibilities under 10 CFR 51.70(b), which in part states, "The NRC staff will independently evaluate and be responsible for the reliability of all information used in the draft environmental impact statement." New and significant information may also be identified by other parties and the NRC in the scoping and public comment process. Guidance on actions that an applicant may take to identify and evaluate the significance of new information is provided in Chapter 5 of this regulatory guide.

Impact Findings

The impacts of the environmental issues that require analyses are to be discussed in proportion to their significance. In assessing the significance of environmental impacts, the applicant should conform to the following general definitions of significance level used in NUREG-1437 and codified 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 considered 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

When adverse environmental effects are identified, 10 CFR 51.45(c) requires consideration of alternatives available for reducing or avoiding these adverse effects. Any ongoing mitigation should be identified and the potential for additional mitigation should be discussed. Mitigation alternatives are to be considered no matter how small the adverse impact; however, the extent of the consideration should be proportional to the significance of the impact. The Council on Environmental Quality in its regulations at 40 CFR 1508.20 identifies five types of mitigative actions.

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

These categories of mitigative actions are used by the NRC in accordance with 10 CFR 51.14(b).

Cumulative, Direct, and Indirect Impacts

Environmental impacts, or effects, include direct effects, indirect effects, and cumulative effects. Each type of effect is to be considered in the assessment of environmental issues and is to be discussed in proportion to the significance of the impact attributed to license renewal. (See Impact Findings above.) Definitions of the three types of effects are given in the Council on Environmental Quality regulations, 40 CFR Part 1508. Cumulative impact is defined in 40 CFR 1508.7.

“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.

Direct and indirect effects are defined in 40 CFR 1508.8.

“Effects” include:

- (1) Direct effects, which are caused by the action and occur at the same time and place.
- (2) Indirect effects, which are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable.

These definitions are used by NRC in accordance with 10 CFR 51.14(b).

OMB Clearance

The information collections contained in this regulatory guide are covered by the requirements of 10 CFR Part 51, which were approved by the Office of Management and Budget, approval number 3150-0021. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

B. STANDARD FORMAT AND CONTENT OF ENVIRONMENTAL REPORTS

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

This chapter should briefly describe the purpose of and need for the proposed action. The Commission identified the purpose of and need for the proposed action in 61 FR 28467 and in NUREG-1437 on pages 1-2; this statement should be included in the applicant’s ER.

The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers.

CHAPTER 2. SITE AND ENVIRONMENTAL INTERFACES

The information in this chapter is intended to allow the reviewer to understand the overall character of the site and local environment. This chapter should describe the plant's setting and the environment affected. The description should give particular attention to information required to address the environmental issues designated Category 2 and environmental justice and to environmental issues raised by new and significant information that has been identified. Guidance on the treatment of these issues is provided in Chapter 4 of this regulatory guide.

The following information should be included in this chapter of the ER.

- Site location: State, county, latitude and longitude Universal Transverse Mercator (UTM) coordinates, township, range, and sections.
- A map of the site showing site boundaries; exclusion area; site structures and facilities; major land uses (with land use classifications consistent with the U.S. Geological Survey (USGS) categories)⁴; 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.
- A map or maps of the site vicinity within about a 10-km (6-mi) radius of the plant showing county and local municipality boundaries; place names; residential areas; airports; industrial and commercial facilities; roads; railroads; major land uses (with land use classifications consistent with the USGS categories); utility rights-of-way; rivers; other bodies of water; wetlands; trust lands; historic sites; archaeological sites; Native American lands; military reservations; and designated Federal, State, and local parks and natural areas. Orient true north at the top of the map.
- A map of the region within about an 80-km (50-mi) radius of the plant showing major civil divisions; highways; transmission corridors serving the plant (specifically identify those transmission lines that were identified in the construction permit review as being constructed to connect the plant to the transmission system); rivers; other bodies of water; Native American lands; military reservations; designated Federal, State, and local parks and natural areas; and nonattainment and maintenance areas defined under the Clean Air Act, as amended (Title 42 U.S.C. 7401, et seq.). Orient true north at the top of the map.

⁴ U.S. Geological Survey, "USGS Land Use and Land Cover Data," USGS Earth Resources Observation Data Center, Sioux Falls, South Dakota, 1997. This reference is on the web at http://edcwww.cr.usgs.gov/glis/hyper/guide/1_250_lulc#lulc16.

To the extent any information provided on a map relates to an issue addressed in Chapter 4, “Environmental Consequences of the Proposed Action and Mitigating Actions,” of this guide or to any new and significant information, that information should be developed in sufficient depth in textual, tabular, and graphic form to support the analysis. The topics listed below correspond to the issues identified in Chapter 4. The level of information provided on each of these topics should be commensurate with the extent of the analysis required. The information identified below should be represented on the maps identified above; separate maps or tables may be used if they better support the analysis specified in Chapter 4.

- Aquatic and riparian ecological communities that may be affected by a once-through or cooling pond heat dissipation system.
- Ground-water resources that may be subject to use conflicts or quality degradation.
- Critical and important terrestrial (plant and animal) habitats that may be disturbed by power plant refurbishment activities or changes in plant operation. Critical habitats are listed and described in 50 CFR 17.95 (fish and wildlife) and 17.96 (plants).⁵
- Threatened or endangered and special concern species identified on the site or within the site vicinity. These species include those:
 - listed at 50 CFR 17.11 (fish and wildlife) or 50 CFR 17.12 (plants)
 - listed as a threatened, endangered, or other species of concern by the host State
 - proposed for listing, or are current candidates for the listing in the *Federal Register*.
- Regional demography, based on the most current (updated) U.S. Census data: population by city, town, and county for those jurisdictions lying fully or partially within 80 km (50 mi) of the plant. Provide by political jurisdiction the composition of minority persons and households below the poverty line within 80 km (50 miles) of the plant. Migrant workers as well as full-time residents should be included. Provide these data by census tract/block for those geographic areas where the potential has been identified for adverse environmental impacts from refurbishment or from continued operation during the renewal term. The most recent Bureau of the Census demographic information should be supplemented with demographic information from State and local planning agencies.
- Information related to the area’s economic base, including construction industry and construction labor force, total regional labor force, unemployment levels, and future economic outlook.
- Housing information, including the sales and rental markets in the region, number and types of units, turnover and vacancy rates, and trends in additions.

⁵ Important habitats that may be adversely affected but have not been designated critical habitats are defined as follows.

- Wildlife sanctuaries, refuges, or preserves
- Habitats identified by the State Natural Heritage Program, the U.S. Fish and Wildlife Service, or the National Marine Fisheries Service as unique, rare, or of priority for protection
- Wetlands (Executive Order 11990), floodplain (Executive Order 11988), or other resources specifically protected by Federal regulations or Executive Orders, or by State regulations.

- Information about the local educational system (regional primary and secondary schools and higher institutions), including present and projected capacity and percentage of utilization.
- Public and private recreational facilities and opportunities, including present and projected capacity and percentage of utilization.
- Regional tax structure and distribution of the present revenues to each jurisdiction and district.
- Local plans concerning land use and zoning that are relevant to population growth, housing, and changes in land use patterns.
- Social services and public facilities, present and projected.
- Data on local and regional meteorology and air quality.
- Historic and archaeological resources.
- 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 should be identified and described.

CHAPTER 3. THE PROPOSED ACTION

The proposed action is described in 10 CFR 51.53(c)(2):

The report must contain 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 modifications directly affecting the environment or affecting plant effluents that affect the environment.

The proposed action is renewal of an operating license and continued operation of the plant during the renewal term, including all attendant activities. In addition to continuing operation and maintenance activities, attendant activities may include refurbishment to allow for extended plant operation and changes to surveillance, on-line monitoring, inspections, testing, trending, and recordkeeping (SMITTR). Refurbishment and SMITTR activities may be undertaken as a result of the 10 CFR Part 54 aging management review, or they may be undertaken for other reasons, such as opportunities for improved economic operation and maintenance during the term of the renewed license. This chapter of the ER should identify those activities attendant to license renewal that can affect the environment external to the plant. The level of detail provided should be sufficient to support the analyses called for in Chapter 4. Possible activities attendant to license renewal are discussed in Chapter 2 of NUREG-1437.

3.1 General Plant Information

Briefly describe the major features of the plant and the operation and maintenance practices directly related to operations under license renewal. Information presented in this section should include descriptions of:

- Reactor and containment systems
- Cooling and auxiliary water systems
- Radioactive waste treatment processes (gaseous, liquid, and solid)
- Transportation of radioactive materials
- Nonradioactive waste systems
- Maintenance, inspection, and refueling activities
- Power transmission systems.

3.2 Refurbishment Activities

Facility refurbishments performed in support of license renewal should be described in this section. These descriptions should identify the major structures and components that will be replaced or modified. The section should identify where materials will be stored between their arrival on the site and installation in the plant, and between their removal from the plant and disposal. If refurbishment activities that directly or indirectly affect the environment will be required, the locations and nature of those activities should be described. This section should identify the schedule for the refurbishment work and describe how it would be integrated with refueling and other maintenance activities. Applicants should ensure that the information in this section meets the information requirements of Chapter 4.

3.3 Programs and Activities for Managing the Effects of Aging

This section should characterize any changes planned in the plant's operating practices, inspections, maintenance activities, systems, and administrative control procedures during the renewal term that are designed to manage the effects of aging. Any specific changes that may lead to environmental impacts should be identified and discussed in detail.

3.4 Employment

Provide current estimates of full-time and occasional onsite (refueling) employment. Provide projections of the incremental onsite work force required for major refurbishment activities or outages associated with license renewal. The employment figures for refurbishment and outages should be presented by the month. Provide projections of any changes anticipated in the full-time and occasional work force during the license renewal term and identify changes in the work force arising from changes in SMITTR activities. For refurbishment and for the renewal term, estimate the number of temporary and permanent in-migrating incremental workers and their dependents, including school-age children, and their anticipated residential distribution.

Provide an estimate of the indirect employment resulting from changes in the full-time and the temporary work forces. This section should address any employment multipliers that were

used and the source or sources of the multipliers, with any additional information needed to verify the appropriateness of the multipliers. Using an estimate of average household size for the region, estimate the change in total population associated with license renewal.

Estimate the residential distribution of the total (direct and indirect) incremental permanent and temporary populations by government jurisdiction or community (e.g., county, city, or town). Absent better assumptions, it may be assumed that the residential pattern will be the same as that of the current and occasional work force.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

General Guidance

NUREG-1437 analyzed 92 environmental issues for license renewal and reached conclusions about the impacts of refurbishment and operation during the license renewal period. For most issues, the GEIS concluded that the impacts were such that the issue met the definition of Category 1 (refer to Table B-1 in Appendix B to Subpart A of 10 CFR Part 51). Part 51 does not require the ER to contain any analyses of Category 1 issues; however, the rule requires that licensees report on any new and significant information that may bear on the applicability of conclusions of NUREG-1437 on Category 1 issues at their plants or on issues not previously identified. The definition of and the process for identifying new and significant information is provided in the Introduction section of this regulatory guide. The applicant may adopt the findings for the codified Category 1 issues, unless the need for additional analysis is triggered by knowledge of new and significant information. Such analysis should be developed according to Section 4.3, "Assessment of New and Significant Information," of this guide.

The sequence of the Category 2 issues covered in this section follows that of Table B-1 in Appendix B to Subpart A of 10 CFR Part 51. Reference is also made to the specific requirements stated in 10 CFR 51.53(c)(3)(ii). The steps for reviewing each Category 2 issue are (1) using the criteria given in 10 CFR 51.53(c)(3)(ii), determine whether the issue is applicable to the plant, (2) if not applicable, provide a short statement on the rationale, and (3) if the issue is applicable, provide the information and analysis specified in the appropriate section below. The information and analysis should be sufficient to determine the size and extent of the impacts associated with the issue and the significance of the impacts as defined in the Impacts Findings section above.

Impacts may be adverse or beneficial and of small, moderate, or large significance. These impact significance levels are defined in Table B-1 of 10 CFR Part 51 and in NUREG-1437 and are explained in the Introduction to this guide.

Direct, indirect, and cumulative effects should be analyzed. The cumulative or indirect effects of the action may be of moderate or large significance even when the direct effect is of small significance. These effects are defined in the Introduction to this guide.

Mitigation measures to eliminate or reduce the level of adverse impacts should be considered for each Category 2 issue. The applicant's effort to identify possible mitigation measures and assess the efficacy of those measures should be in proportion to the significance of the impact. If no suitable mitigation measure is identified, the basis of that finding should be provided. For suitable mitigation measures, the applicant should describe the benefits and costs of each of the measures and indicate which measures, if any, would be implemented if the license is renewed. If suitable mitigation measures will not be implemented, the applicant should explain the rationale. Mitigation measures are defined in the Introduction to this guide.

4.1 Water Use Conflicts

This section applies to plants with cooling ponds or cooling towers using makeup water from a small river with low flow.

Table B-1 notes that the impacts of this issue are anticipated to be small or moderate and that

The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations.

Specifically, 10 CFR 51.53(c)(3)(ii)(A) requires, in part, that

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than 3.15×10^{12} ft³/year (9×10^{10} m³/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided.

This issue is discussed in Sections 4.3.2.1 and 4.4.2.1 of NUREG-1437.

If the plant does not use cooling towers or cooling ponds, the ER should note this fact; no additional information is needed with reference to these issues.

If the plant takes its makeup water for the cooling towers or cooling ponds from a river with an annual flow greater than 3.15×10^{12} ft³/year (9×10^{10} m³/year), the licensee should report this fact. The method used to determine the annual flow should be provided and explained, and no further information is needed with reference to these issues. If the plant does not meet the above conditions, the information and analysis described below in Sections 4.1.1 and 4.1.2 must be responsive to the requirements of 10 CFR 51.53(c)(3)(ii)(A) specified above.

INFORMATION AND ANALYSIS CONTENT

4.1.1 Instream Ecological Communities

Consumption of water by the plant may significantly reduce the amount of habitat available to aquatic organisms, either year-round or seasonally. Increasing water demand (e.g., as a result of

population growth) may result in additional impacts to aquatic habitats that were not anticipated during the initial licensing. Information and analysis requirements for this issue may be restricted to consideration of impacts on one or a few aquatic species, as appropriate. As needed, existing and potential measures to mitigate losses of aquatic habitats from cooling water withdrawals should be described, and the effects of these measures should be estimated. The following process for developing and presenting information should be used.

1. Document any consultations with regulatory agencies (e.g., U.S. Environmental Protection Agency (EPA), State water resources control boards) and resource agencies (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service, State fish and wildlife agencies) related to the issue of consumptive water use and its effects on instream communities.⁶ Summarize the results of such consultations, identifying agreements that describe (a) the nuclear power plant's standing in priority for makeup water withdrawals or (b) the criteria for reducing the withdrawal of makeup water in order to protect instream habitats and aquatic biota during low-flow periods. If the regulatory and resources agencies concur that these agreements or criteria are sufficiently protective of instream communities, further considerations of the issue of effects of water use conflicts on instream communities may be omitted. If further analysis of water use conflicts is needed, and consultation with regulatory and resource agencies indicates concerns about only one or a few aquatic species, the information and analysis required in the following items may be restricted to only that needed to address effects on those species. Identify and unambiguously define the resource or resources of concern.
2. Describe the fish and shellfish community in the source water body in Chapter 2. Lists of species and estimates of the numbers of fish and shellfish that are present in the portion of the water body affected by consumptive water use should be included. The distribution and value of commercial and sport fisheries should be discussed. The locations of important habitats for fish and shellfish (e.g., spawning areas, nursery grounds, feeding areas, wintering areas, and migration routes) within the area affected by consumptive water use should be fully described.
3. Include estimates of the quantities and timing of cooling water withdrawals and discharges in Chapter 3. Estimate current consumptive water use and future consumptive water use during the license renewal period.
4. Compare the consumptive water used by the heat-dissipation system to flows in the source water body (i.e., the stream from which water is withdrawn for cooling tower or cooling pond makeup water). This comparison should be based on records of the initial license period. Project and compare consumptive use and stream flows during the license renewal period.

⁶ The prospective applicant should be aware of the consultation requirements of the Endangered Species Act. If threatened or endangered species, or proposed species, are identified, the prospective applicant should follow the procedures given in Section 4.10 for consultation with the U. S. Fish and Wildlife Service and the National Marine Fisheries Service.

5. 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.
6. Estimate the effects of consumptive water use by the nuclear power plant on aquatic habitats in the water body and discuss the significance of these effects in terms of changes in populations of individual species. Describe the techniques used to estimate the habitat changes that result from water withdrawals.
7. Estimate the total (cumulative) effects of all water withdrawals on aquatic habitats and populations of individual species in the water body (i.e., the effects of power plant withdrawals during the license renewal period in combination with other existing and foreseeable future withdrawals).
8. Describe mitigation measures (e.g., limiting withdrawals during droughts) that have been used to reduce the adverse impacts on aquatic habitats of consumptive water use and the mitigation measures that are expected to be used during the license renewal period. Briefly explain the rationale for not implementing any measures that were considered but rejected.

4.1.2 Riparian Ecological Communities

The primary impacts expected are reduction in the areal extent or species composition of riparian communities. Consumption of water by the plant may significantly reduce the amount of habitat available to riparian ecological communities, either year-round or seasonally. Increasing water demand (e.g., as a result of population growth) may result in additional impacts to riparian ecological communities that were not anticipated during the initial licensing. The methods used to determine the characteristics and magnitude of impacts should be explained and documented. As needed, existing and potential measures to mitigate adverse impacts on riparian ecological communities should be described, and the effects of these measures should be estimated. The following process for developing and presenting information should be used.

1. Document any consultations with regulatory agencies (e.g., EPA, State water resources control boards) and resource agencies (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service, State fish and wildlife agencies) related to the issue of consumptive water use and its effects on stream-related habitat and riparian ecological communities.⁶ Summarize the results of such consultations, identifying agreements that describe (a) the plant's priority for makeup water withdrawals or (b) the criteria for reducing the withdrawal of makeup water in order to protect stream-related habitat and riparian ecological communities during low-flow periods. If the regulatory and resource agencies concur that these agreements or criteria are sufficiently protective of riparian communities, further consideration of the issue of water use conflicts on riparian ecological communities may be omitted. If further analysis is needed, and consultation with regulatory and resource agencies indicates concerns about only one or a few types of riparian ecological communities or species in these communities, the information and analyses required in the following items may be restricted to only that needed to address effects on those community types or species. Identify and unambiguously define the resource or resources of concern.

2. Describe the riparian ecological community in the source water body in Chapter 2. For the portions of the water body affected by consumptive water use, describe the associated riparian ecological community types, including (a) their extent and locations, (b) lists of plant and animal species they contain, and (c) estimates of the abundance of those species.
3. Include estimates of the quantities and timing of cooling water withdrawals and discharges in Chapter 3 and in 4.1.1 Instream Ecological Communities. Estimate consumptive water use during the initial license period and during the license renewal period.
4. Compare consumptive water use by the heat-dissipation system to flows in the source water body (i.e., the stream from which water is withdrawn for cooling tower or cooling pond makeup water). This comparison should be based on records of the initial license period and, if expected to be different, projected consumptive use and stream flows during the license renewal period.
5. 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.
6. Provide an explanation of the mechanisms by which the riparian ecological communities that are present would be likely to be affected by the loss of flow attributed to makeup water (e.g., depression of the water table or loss of nutrient replenishment because of decreased floods).
7. Estimate the effects of consumptive water use by the plant on the riparian ecological communities associated with the water body. Describe the techniques used to estimate the changes in these communities that result from water withdrawals. The estimates should be expressed in units appropriate to the particular resources under consideration (e.g., percent loss of habitat, number of plants or animals affected, number of acres affected, percent reduction in harvest).
8. Describe mitigation measures (e.g., limiting water withdrawals during droughts) used to reduce the adverse impacts of consumptive water use on riparian ecological communities and the mitigation measures that are expected to be used during the license renewal period. Briefly explain the rationale for not implementing measures that were considered but rejected.

4.2 Entrainment of Fish and Shellfish in Early Life Stages

This section applies to plants with once-through cooling or cooling pond heat dissipation systems. Table B-1 notes that

The impacts of 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. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal

period, such that entrainment studies conducted in support of the original license may no longer be valid.

Specifically, 10 CFR 51.53(c)(3)(ii)(B) requires, in part, that

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 can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from . . . entrainment.

This issue is discussed in Sections 4.2.2.1.2 and 4.4.3 of NUREG-1437.

If the plant does not use once-through cooling or closed-cycle cooling pond heat dissipation systems, the ER should note this fact and no additional information is needed for this issue.

If the plant uses a once-through or closed-cycle cooling pond heat dissipation system and the applicant holds a current Clean Water Act Section 316(b) determination, copies of the determination, supporting documentation, and relevant correspondence with the water quality permitting agency (EPA or permitted State agency) should be provided to the NRC. Information about how mitigation measures were considered during the permit process, and any commitment to mitigation measures, should be provided.

If (a) the plant utilizes a once-through or cooling pond heat dissipation system and (b) the applicant does not possess a current Clean Water Act Section 316(b) determination, the issue of entrainment of fish and shellfish in early life stages must be considered in the ER; this information is outlined below.

Information and Analysis Content

Sufficient information should be provided in the ER to put into perspective the loss to entrainment of fish and shellfish in their early life stages, not only in terms of the overall numbers of eggs, larvae, and juveniles in the water body, but also in terms of the numbers of adult fish and shellfish that these losses represent. Existing and potential new measures to mitigate entrainment losses should also be fully described, and the effects of these measures should be estimated. The following process for developing and presenting information should be used.

1. Document any consultations with regulatory agencies (e.g., EPA or other water quality permitting agencies) and resource agencies (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service, State fish and wildlife agencies) regarding the issue of entrainment.⁶ Provide a copy of any Clean Water Act Section 316(b) demonstration. 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. If consultation with regulatory and

resource agencies indicates concerns about only one or a few aquatic species, the information and analysis required in the following items may be restricted to only that needed to address effects on those species. Identify and unambiguously define the resource or resources of concern.

2. From Chapter 2 of the ER, describe the fish and shellfish resources in the vicinity of the plant susceptible to entrainment. Include lists of species and estimates of the numbers of entrainable fish and shellfish in the water body. The distribution and value of commercial and sport fisheries should be discussed. Locations of important habitats for entrainable fish and shellfish (e.g., spawning areas, nursery grounds, feeding areas, wintering areas, and migration routes) should be described.
3. From Chapter 3 of the ER, describe the cooling system, including the rates of water withdrawal, the flow rates or volume of the water body from which cooling water is withdrawn, and the location of water withdrawal. The intake structure and any structural or operational measures used to reduce entrainment of fish and shellfish should be described in detail.
4. Provide estimates of the species and numbers of fish and shellfish entrained on a daily, monthly, and annual basis.
5. Provide estimates of the mortality of entrained fish and shellfish in early life stages.
6. Provide estimates of the numbers of adult fish and shellfish that are lost to the water body because of entrainment in early life stages. Provide full documentation of analytical or modeling techniques that were used to extrapolate local entrainment losses to resulting long-term, far-field effects. As appropriate, compare these "equivalent adult" losses to the total estimated numbers of adults in the water body and commercial and recreational harvests.
7. If aquatic resources have been monitored, provide an analysis of time trends in the data that might indicate whether fish and shellfish populations have increased, decreased, or remained stable during the initial period of operation. Possible causes for these time trends should be discussed.
8. Identify and, to the extent possible, quantify losses of fish and shellfish from other sources (e.g., other water withdrawals, temperature and water quality problems, impingement of juveniles and adults) in order to assess possible cumulative effects of plant entrainment losses when combined with other losses.
9. Describe mitigation measures that have been used to reduce the adverse impacts of entrainment during the initial license period. Identify additional mitigation measures that could be used to reduce entrainment impacts during the license renewal period. Explain the rationale for accepting or rejecting additional mitigation measures. Describe in detail the additional mitigation measures that are expected to be used during the license renewal period and their expected effects on entrainment losses.

4.3 Impingement of Fish and Shellfish

This section applies to plants with once-through and cooling pond heat dissipation systems. Table B-1 notes that

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

Specifically, 10 CFR 51.53(c)(3)(ii)(B) requires, in part, that

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 can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from . . . impingement

This issue is discussed in Sections 4.2.2.1.3, 4.3.3, and 4.4.3 of NUREG-1437.

If the plant does not use a once-through cooling or closed-cycle cooling pond heat dissipation system, the ER should note this fact and no additional information is needed for this issue.

If the plant uses a once-through or closed-cycle cooling pond heat dissipation system and the applicant holds a current Clean Water Act Section 316(b) determination, copies of the determination, supporting documentation, and relevant correspondence with the water quality permitting agency (EPA or permitted State agency) should be provided to the NRC. Information about how mitigation measures were considered during the permit process, and any commitment to mitigation measures, should be provided.

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

Information and Analysis Content

Sufficient information should be provided in the ER to put the loss of fish and shellfish to impingement mortality in perspective, not only in terms of the overall numbers of juveniles and adults in the water body, but also in terms of the numbers of adult fish and shellfish that these losses represent. Existing and potential new measures to mitigate impingement losses should also be fully described, and the effects of these measures should be estimated.

- 1.** Document any consultations with regulatory agencies (e.g., EPA or other water quality permitting agencies) and resource agencies (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service, State fish and wildlife agencies) regarding the issue of

impingement.⁶ Provide a copy of any Clean Water Act Section 316(b) demonstration. 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. If consultation with regulatory and resource agencies indicates concerns about only one or a few aquatic species, the information and analysis required in the following items may be restricted to only that needed to address effects on those species. Identify and unambiguously define the resource or resources of concern.

2. From Chapter 2 of the ER, describe the fish and shellfish resources in the vicinity of the plant that are susceptible to impingement. Include lists of species and estimates of the numbers of impingeable fish and shellfish in the water body. The distribution and value of commercial and sport fisheries should be discussed. Locations of important habitats for impingeable fish and shellfish (e.g., spawning areas, nursery grounds, feeding areas, wintering areas, and migration routes) should be described.
3. From Chapter 3 of the ER, describe the cooling system, including the rates of water withdrawal, the flow rates or volume of the water body from which cooling water is withdrawn, and the location of water withdrawal. The intake structure, intake screens, and any structural or operational measures used to reduce impingement of fish and shellfish should be described in detail.
4. Provide estimates of the species and numbers of fish and shellfish impinged on a daily, monthly, and annual basis.
5. Provide estimates of the mortality of impinged fish and shellfish.
6. Provide estimates of the numbers of adult fish and shellfish that are lost to the water body because of impingement. Provide full documentation of analytical or modeling techniques that were used to extrapolate localized impingement losses to resulting long-term, far-field effects. As appropriate, express these "equivalent adult" losses in terms of the total estimated numbers of adults in the water body and commercial and recreational harvests.
7. If aquatic resources have been monitored, provide an analysis of time trends in the data that might indicate whether fish and shellfish populations have increased, decreased, or remained stable during the initial period of operation. Possible causes for these time trends should be discussed.
8. Identify and, to the extent possible, quantify losses of fish and shellfish from other sources (e.g., other water withdrawals, temperature and water quality problems, entrainment of early life stages) in order to assess possible cumulative effects of power plant impingement losses when combined with other losses.
9. Describe mitigation measures that have been used to reduce the adverse impacts of impingement during the initial license period. Describe additional mitigation measures that are expected to be used during the license renewal period and their expected effects on

impingement losses, and briefly explain the rationale for not implementing any measures that were considered but rejected.

4.4 Heat Shock

This section applies to plants with once-through and cooling pond heat dissipation systems. Table B-1 notes that

Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants.

Specifically, 10 CFR 51.53(c)(3)(ii)(B) requires, in part, that

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 can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock

This issue is discussed in Sections 4.2.2.1.4 and 4.4.3 of NUREG-1437.

If the plant does not use a once-through cooling or closed-cycle cooling pond heat dissipation system, the ER should note this fact and no additional information is needed for this issue.

If the plant uses a once-through or closed-cycle cooling pond heat dissipation system and the applicant holds a current NPDES permit that demonstrates that the plant meets State water temperature standards, or a current Clean Water Act Section 316(a) determination, copies of the determination, NPDES permit, supporting documentation, and relevant correspondence with the water quality permitting agency (EPA or permitted State agency) should be provided to the NRC. Information about how mitigation measures were considered during the permit process should be provided, as well as any commitments to mitigation measures.

If (a) the plant uses a once-through or cooling pond heat dissipation system and (b) the applicant does not possess a current NPDES permit that demonstrates that the plant meets State water temperature standards or possess a current Clean Water Act Section 316(a) determination, the issue of heat shock must be considered in the ER. Information that should be provided for review and analysis of the heat shock issue is outlined below.

Information and Analysis Content

Sufficient information should be provided to the NRC to allow the reviewer to put in perspective the loss of fish and shellfish to heat shock, not only in terms of the overall numbers of eggs, larvae, juveniles, and adults in the water body, but also in terms of the numbers of adult fish

and shellfish that these losses represent. Existing and potential new measures to mitigate heat shock losses should also be fully described, and the effects of these measures should be estimated. The following process for developing and presenting information should be used.

1. Document any consultations with regulatory agencies (e.g., EPA or other water quality permitting agencies) and resource agencies (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service, State fish and wildlife agencies) regarding the issue of heat shock.⁶ Provide copies of any NPDES permits and Clean Water Act Section 316(a) determination. If a current NPDES permit relative to thermal discharges and/or a current Section 316(a) variance from State water temperature standards do not exist, discuss the outstanding issues. If consultation with regulatory and resource agencies indicates concerns about only one or a few aquatic species, the information and analysis required in the following items may be restricted to only that needed to address effects on those species. Identify and unambiguously define the resource or resources of concern.
2. From Chapter 2 of the ER, describe the fish and shellfish resources in the vicinity of the plant that are susceptible to heat shock. Include lists of species and estimates of the numbers of fish and shellfish in the water body that are susceptible to heated discharges. The distribution and value of commercial and sport fisheries should be discussed. Locations of important fish and shellfish habitats (e.g., spawning areas, nursery grounds, feeding areas, wintering areas, and migration routes) should be fully described. The important habitats that could be affected by thermal discharges should be identified.
3. From Chapter 3 of the ER, describe the cooling system, including heated water discharge rates, the flow rates or volume of the water body into which heated water is discharged, and the location of heated water discharge. The discharge structure and any structural or operational measures used to reduce heat shock to fish and shellfish should be described in detail. The location, temperatures, and areal extent of the heated discharge plume should be described; all techniques used to estimate these parameters (e.g., temperature monitoring, simulation monitoring) should be reported.
4. Provide estimates, on a daily, monthly, and annual basis, of the species and numbers of fish and shellfish susceptible to heat shock.
5. Provide estimates of the mortality of heat-shocked fish and shellfish.
6. Provide estimates of the numbers of adult fish and shellfish that are lost to the water body because of heat shock. Provide full documentation of analytical or modeling techniques that were used to extrapolate localized heat shock losses to resulting long-term, far-field effects. As appropriate, express these "equivalent adult" losses in terms of the total estimated numbers of adults in the water body and commercial and recreational harvests.
7. If aquatic resources have been monitored, provide an analysis of time trends in the data that might indicate whether fish and shellfish populations have increased, decreased, or remained stable during the initial period of operation. Possible causes for these time trends should be discussed.

8. Identify and, to the extent possible, quantify losses of fish and shellfish from other sources (e.g., other water withdrawals and discharges, temperature and water quality problems, entrainment and impingement) in order to assess possible cumulative effects of heat shock losses when combined with other losses.
9. Describe mitigation measures that have been used to reduce the adverse impacts of heat shock during the initial license period. Describe additional mitigation measures that could be used during the license renewal period and their expected effects on heat shock losses. Identify mitigation measures that will be implemented, and briefly explain the rationale for not implementing any measures that were considered but rejected.

4.5 Ground-Water Use Conflicts (Plants Using >100 gpm of Ground Water)

This section applies to plants that use more than an annual average of 100 gpm (6 L/s) of ground water.

Table B-1 reports that

Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users.

Specifically, 10 CFR 51.53(c)(3)(ii)(C) requires in part that

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

This issue is discussed in Section 4.8.1 of NUREG-1437. This section provides guidance to the applicant for identification and assessment of the environmental impacts of ground-water withdrawal and use during the license renewal period. 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 ground water, the ER should note this fact, and no additional information is needed on this issue.

Information and Analysis Content

If the plant pumps more than an annual average of 100 gpm, the following information and analyses should be provided to assess the magnitude and significance of potential ground-water use conflicts during operation.

1. A description of all groundwater aquifers potentially impacted by operation of on-site wells, including approximate areal extent, thickness, porosities, and hydraulic conductivities of aquifer strata. The descriptions should discuss significant uncertainties and inhomogeneities.

2. A description of existing and known future off-site and on-site wells, including average flowrate, peak flowrate, water use, and completion depth.
3. Maps of steady-state piezometric surfaces estimated with on-site and off-site 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 the onsite wells and with the drawdown of the piezometric surface attributable to the offsite wells. Describe the methods of analysis, including assumptions used.
4. A description of existing and known future water rights (including Native American tribal water rights).
5. A description of any wetlands in the vicinity that might be impacted by a lowered watertable.
6. An evaluation of the significance of present and future effects of onsite withdrawal on offsite wells and an assessment of the need for mitigation measures to reduce the adverse impacts, if any.
7. If a need for mitigation measures is found, discuss possible measures and whether they will be implemented.

4.6 Ground-Water Use Conflicts (Plants Using Cooling Towers Withdrawing Make-Up Water from a Small River)

This section applies to plants using cooling towers withdrawing makeup water from a small river.

Table B-1 reports that

Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other ground-water or upstream surface water users come on line before the time of license renewal.

Specifically, 10 CFR 51.53(c)(3)(ii)(A) requires in part that

If the applicant's plant utilizes cooling towers . . . and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft³/year (9×10^{10} m³/year) The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

This issue is discussed in Section 4.8.1.3 of NUREG-1437.

If the applicant can provide evidence in the ER that its plant does not withdraw cooling tower make-up water from a small river [annual flow rate less than 3.15×10^{12} ft³/year (9×10^{10} m³/year)], no additional information is needed on this issue.

Information and Analysis Content

If the plant withdraws cooling tower make-up water from a small river, the following information and analyses should be provided to assess the ground-water use conflicts during operation.

1. A description of alluvial aquifers near the site that could be affected by surface-water withdrawal, including approximate areal extent, thickness, porosities, and hydraulic conductivities of aquifer strata.
2. A description of existing and known future off-site and on-site wells, including average flow rate, peak flow rate, water use, and completion depth.
3. Maps of steady-state piezometric surface estimated with on-site and off-site wells at peak pumpage, average pumpage, and no pumpage. 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 the onsite wells and with the drawdown of the piezometric surface attributable to the offsite wells.
4. A description of existing and known future water rights (including Native American tribal water rights).
5. A description of any wetlands in the vicinity that might be impacted by a lowered water table.
6. An evaluation of the significance of present and future effects of onsite withdrawal on offsite wells and wetlands, and the need for mitigation measures to reduce the adverse impacts.
7. Possible mitigation measures, if they are needed, and whether they will be implemented.

4.7 Ground-Water Use Conflicts (Plants Using Ranney Wells)

This section applies to plants using Ranney wells for cooling tower make-up water. This section provides guidance to the applicant on identification and assessment of the environmental impacts of ground-water withdrawal and use during the license renewal period. If the plant does not use Ranney wells, the ER should note the fact without further discussion.

This issue is a combination of two related issues discussed in Section 4.8.1 of NUREG-1437.

Table B-1 reports that

Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal.

Specifically, 10 CFR 51.53(c)(3)(ii)(C) requires in part that

If the applicant's plant uses Ranney wells . . . an assessment of the impact of the proposed action on ground-water use must be provided.

If the plant does not use Ranney wells, this fact should be noted in the ER and no further information need be provided.

Information and Analysis Content

If the plant uses Ranney wells, the following information and analyses should be provided to assess the magnitude and significance of potential ground-water use conflicts during operation.

1. A description of alluvial aquifers near the site that could be affected by surface-water withdrawal, including their approximate areal extent, thickness, porosities, and hydraulic conductivities of aquifer strata.
2. A description of existing and known future off-site and on-site wells, including average flow rate, peak flow rate, water use, and completion depth.
3. Maps of steady-state piezometric surface estimated with on-site and off-site wells at peak pumpage, average pumpage, and no pumpage. 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 the onsite wells and with the drawdown of the piezometric surface attributable to the offsite wells.
4. A description of existing and known future water rights (including Native American tribal water rights).
5. A description of any wetlands in the vicinity that might be impacted by a lowered water table.
6. An evaluation of the significance of present and future effects of onsite withdrawal on offsite wells (including changes in groundwater quality) and wetlands, and the need for mitigation measures to reduce the adverse impacts.
7. Possible mitigation measures, if they are needed, and whether they will be implemented.

4.8 Degradation of Ground-Water Quality

This section applies to plants at inland sites with cooling ponds.

Table B-1 notes that

Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses.

Specifically, 10 CFR 51.53(c)(3)(ii)(D) requires that

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 ground-water quality must be provided.

This issue is discussed in Section 4.8.3 of NUREG-1437.

If the plant does not use cooling ponds or if the cooling ponds are adjacent to salt marshes, the ER should note the fact and no further information need be provided.

Information and Analysis Content

If the plant uses cooling ponds and is not adjacent to salt marshes, the following information and analyses should be provided to assess the presence and magnitude of ground-water quality degradation during operation.

1. Cooling pond characteristics (e.g., liners or impermeable materials used, impermeable soils) that would retard or prevent infiltration into local aquifers.
2. Types and concentrations of impurities in the cooling pond water and chemistry of soils along pathways to local aquifers to determine whether cooling pond water can contaminate the ground water.
3. Water quality and other characteristics of local aquifers that could be affected by infiltration of cooling pond water.
4. Federal, State, and local ground-water quality requirements with emphasis on any changes to these requirements that have occurred during the plant's initial license term and any anticipated changes to those requirements during the license renewal term.
5. Identification and characterization of offsite ground-water users who could be affected by the degradation of aquifers. Characterization should include locations and elevations of off-site wells, their pumping rates, and the water needs of ground-water users.
6. A quantitative description of the cumulative effects of using closed cycle cooling ponds on ground-water quality. This description should include maps of the contaminant plume. Information should be provided on ground-water contamination existing at the time of license renewal application and projected contamination during the license renewal period.

7. The mitigation measures proposed to avoid or minimize ground-water quality degradation and the estimated impact of implementing those measures. Briefly explain the rationale for not implementing any measures that were considered but rejected.

4.9 Impacts of Refurbishment on Terrestrial Resources

Table B-1 notes that

Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application.

Specifically, 10 CFR 51.53 (c)(3)(ii)(E) requires in part that

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

This issue is discussed in Section 3.6 of NUREG-1437.

The applicant should describe in Chapter 3 of the ER any activities associated with license renewal that will involve disturbance of any plant or wildlife habitat. If no area will be disturbed, the fact should be noted in Section 4.2.9 of the ER, and no further discussion of the issue is needed. Areas to be disturbed should be described in Chapter 2 of the ER 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 unique. Note that the information and analysis for this issue overlaps the information and analysis covered in Section 4.10 of this guide for assessing impacts on threatened and endangered species.

Information and Analysis Content

If any license renewal activity will disturb any plant or wildlife habitat, the following information and analyses should be provided.

1. The applicant should determine whether any of the plant and animal species are important. Important species are those that either (1) have high public interest or economic value or both or (2) may be critical to the structure and function of the ecosystem or provide a broader ecological perspective of an area. Important habitats are defined as those that support important species.⁷ Specific guidance on identifying important species to be evaluated is found in “U.S. Fish and Wildlife Service Mitigation Policy; Notice of Final

⁷ Important plant or animal habitats are often characterized by high biological productivity or diversity. Examples include habitats used by Federal or State threatened or endangered species, wetlands, riparian zones, staging or resting areas for large numbers of waterfowl, rookeries, restricted wintering areas for wildlife (e.g., winter deer yards), communal roost sites, strutting or breeding grounds of gallinaceous birds, rare plant community types (e.g., Atlantic white cedar swamps), and other such areas.

Policy.”⁸ Federal, State, and regional government agencies with jurisdiction over biological resources, and organizations concerned with such resources like the State office of The Nature Conservancy, should be consulted to assist with the identification of important species and habitats. If no important species is identified, the basis for this finding should be summarized in Section 4.2.9 of the ER, and no further discussion of this issue is needed.

2. If important plant or animal species are identified, the significance of the loss in population of the species should be assessed with respect to local, regional, and national social, economic, and ecological value.
3. Mitigation measures that are proposed, considered, or adopted to minimize the adverse impacts should be described. Briefly explain the rationale for not implementing any measures that were considered but rejected. Further guidance on determining the appropriate level of mitigation and methods for accomplishing mitigation can be found in the U.S. Fish and Wildlife Service Mitigation Policy (46 FR 7644, January 23, 1981).

4.10 Threatened or Endangered Species

Table B-1 notes that

Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected.

Specifically, 10 CFR 51.53(c)(3)(ii)(E) requires, in part, that

. . . . Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act.

This issue is discussed in Sections 2.3.6, 3.9, and 4.1 of NUREG-1437.

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 *et seq.*), 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 an endangered species or their habitats. If such review reveals the potential for adversely affecting listed or candidate species, the Federal agency must consult with the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS), as appropriate. The interagency cooperation provisions of Section 7 are implemented by the FWS and the NMFS at 50 CFR Part

⁸ The notice (46 FR 7644, January 23, 1981) establishes final policy guidance for U.S. Fish and Wildlife Service personnel involved in making recommendations to protect or conserve fish and wildlife resources. Guidance is provided on the definition and identification of “evaluation species,” evaluation of direct and indirect effects of a project on the evaluation species, on the levels of mitigation and on the various methods for accomplishing mitigation when adverse effects are identified. The types of species that should be considered are discussed in the notice at pages 7662 and 7663. In this regulatory guide, the terms “important species” and “evaluation species” are used interchangeably.

402. Further, Section 9 of the ESA prohibits certain actions by a Federal agency, licensee, or potential licensee that may hurt an endangered species or its habitat. The prohibited acts provisions of Section 9 are implemented at 50 CFR 17.31(a) and 17.71(a).⁹

The applicant should determine whether the site and vicinity are within the range of listed species, and if they are, an assessment is made of the extent to which refurbishment activities associated with license renewal and continued plant operation are likely to jeopardize the continued existence of those listed species or to 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 FWS or NMFS, the prospective applicant should notify NRC so that the NRC can coordinate the consultation. Three levels of consultation are identified in 50 CFR Part 402, Subpart B—Consultation Procedures: (1) Early consultation (Sec. 402.11), (2) Informal consultation (Sec. 402.13), and (3) Formal consultation (Sec. 402.14). Most consultations are conducted informally with Federal agencies. If a prospective applicant feels a need to discuss data availability and interpretation with either FWS or NMFS, the NRC should be requested to initiate informal consultation. The prospective applicant should request NRC to initiate early consultation when, in developing information on threatened or endangered species, there is reason to believe that an endangered species or a threatened species may be present in the area affected by its project and that implementation of such action will likely affect such species. Consultation, as defined in 50 CFR Part 402, may not always be needed to complete this section of the ER. If the consultation process has not been initiated prior to submittal of the ER, NRC will fulfill its consultation requirements in preparing the SEIS. Consultation procedures are discussed in “Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act,” U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998.

Information and Analysis Content

The ER should include the following.

1. Reference should be made to threatened or endangered species, or candidate species, and critical habitat that may be found on the site or in the vicinity of the site as identified in Chapter 2; this should include the area within the applicant’s transmission line corridor identified in Chapter 2 as being constructed to connect the plant to the transmission system. Reference should be made to any license renewal activities that will disrupt any natural areas and to modifications to plant operation that may change the effect on the environment, as identified in Chapter 3. If there has been early consultation with the FWS or the NMFS, reference should be made to any resulting FWS or NMFS memoranda.
2. Reference should be made specifically to any adverse impacts on listed and candidate threatened or endangered species or critical habitat found in the review of the topics in the following 10 sections of this guide.

⁹ An explanation of the structure and implementation of the ESA is found in Ray Vaughan, *Endangered Species Act Handbook*, Government Institutes, Inc., Rockville, MD, 1994.

- 4.1.1 Instream Ecological Communities
 - 4.1.2 Riparian Ecological Communities
 - 4.2 Entrainment of Fish and Shellfish in Early Life Stages
 - 4.3 Impingement of Fish and Shellfish
 - 4.4 Heat Shock
 - 4.5 Ground-Water Use Conflicts (Plants Using >100 gpm of Ground Water)
 - 4.6 Ground-Water Use Conflicts (Plants Using Cooling Towers Withdrawing Make-Up Water from a Small River)
 - 4.7 Ground-Water Use Conflicts (Plants Using Ranney Wells)
 - 4.8 Degradation of Ground-Water Quality
 - 4.9 Impacts of Refurbishment on Terrestrial Resources
3. A determination should be made whether the information from items 1 and 2 can support a conclusion either that there are no candidate, threatened, or endangered species or critical habitat in the site vicinity or that there are no activities associated with license renewal or changes in plant operating conditions that would adversely affect such species or critical habitat, if present. If such a determination can be made, it should be documented in this section, and no further analysis is required.
4. If the determination described in item 3 can not be made, an assessment of whether license renewal is likely to affect endangered species should be made. The content of the assessment should be guided by the content of a biological assessment suggested at 50 CFR 402.12(f).¹⁰ Early discussions with the State wildlife or fisheries agency, the State's Natural Heritage Program, local field offices of the FWS or NMFS, and the State office of The Nature Conservancy can provide useful information for designing the biological assessment. At this point in the development of the ER, discussion with the FWS or the NMFS would constitute either informal or early consultation, therefore the potential applicant should immediately request guidance on the early consultation process from the NRC. As a result of consultation, FWS or NMFS may require a biological assessment, especially if there are construction activities involved in license renewal.
5. If the assessment supports a determination that license renewal will not adversely affect listed or candidate species, the determination should be documented in this section. Documentation should include a description of the assessment and contacts with government agencies and private organizations. If a biological assessment is prepared, it should be provided to the NRC for submittal to the FWS or the NMFS for review and issuance of a preliminary biological opinion. Concerns raised by these agencies should be resolved, to the extent possible, to minimize the potential for endangered species being an issue during the NRC review and the FWS and NMFS review of the draft SEIS. The biological assessment should be included in the Environmental Report, and the biological opinion should also be included if it is available when the application is submitted.
6. If the biological assessment results in a determination of "may affect" listed species or designated critical habitat, or if the FWS or NMFS does not concur in writing with a

¹⁰ "Assessment" refers to the information and analysis that is presented in the Environmental Report only. "Biological assessment" refers to the document prepared in conformance with the provisions of 50 CFR Part 402.

finding that there will be no effects, or that the reasonably expected effects will be beneficial, insignificant, or discountable, the NRC will initiate formal consultation with the FWS or the NMFS in accordance with Section 7(a)(3) of the ESA. The applicant must participate fully in the consultation and furnish NRC with any additional information or studies that may be required. Requirements for formal consultation are given in 50 CFR 402.14 and in Chapter 4 of the Consultation Handbook. The status of consultation activities and findings, including a biological opinion issued by FWS or NMFS prior to submittal of an application, should be reported in the ER.

7. If a “jeopardy” opinion is issued, the applicant will be responsible for considering and responding, through the NRC, to any reasonable and prudent alternatives identified in the biological opinion. The response must be in accordance with the “incidental take” provisions at 10 CFR 402.14(i).

4.11 Air Quality During Refurbishment (Nonattainment Areas)

Table B-1 states that

Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage.

Specifically, 10 CFR 51.53(c)(3)(ii)(F) requires that

If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment work force must be provided in accordance with the Clean Air Act as amended.

The 1990 amendments to the Clean Air Act include a provision that no Federal agency may support any activity that does not conform to a State Implementation Plan (SIP) designed to achieve the National Ambient Air Quality Standards (NAAQS).¹¹ On November 30, 1993, the EPA issued a final rule implementing the new statutory requirements for this provision (58 FR 63214); the rule was effective January 31, 1994.¹² The final rule requires that Federal agencies prepare a written conformity analysis and determination for proposed actions in NAAQS nonattainment or maintenance areas for which the total of the action’s direct and indirect emissions that contribute to criteria pollutants (i.e., ozone, carbon monoxide, sulfur dioxide,

¹¹ Conformity is defined in Section 176(c) of the Clean Air Act as conformity to the SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards, and that such activities will not (1) cause or contribute to any new violation of any standard in any area, (2) increase the frequency or severity of any existing violation of any standard in any area, or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

¹² The regulatory requirements are in Subpart W, “Determining Conformity of General Federal Action to State and Federal Implementation Plans,” in 40 CFR Part 51.

nitrogen dioxide, lead, and particulate matter less than 10 microns in diameter) would exceed threshold emission levels of 40 CFR 51.853(b).^{13,14}

The threshold emission levels serve as a screen to determine whether a conformity analysis should be performed for a proposed action. The threshold emission levels range from 10 to 100 tons (9 to 91 metric tons) per year. The EPA considers it extremely unlikely that emissions below the threshold emission levels would affect a nonattainment or maintenance area. If the threshold emission levels are not exceeded, a conformity analysis is not required unless the total direct and indirect emissions are 10% or more of a nonattainment or maintenance area's total emissions for that pollutant. Under this latter scenario, the action is defined as a "regionally significant action" and requires a conformity analysis.

Information and Analysis Content

The applicant should consult with the appropriate EPA regional office and the State air quality regulatory agency. Discussions with staff at EPA regional offices indicate that there may be some flexibility in the rigor of the analysis that would be acceptable, depending on the particular site, the extent of refurbishment, the pollutants in nonattainment, the severity of the nonattainment, and the State regulatory agency. Such consultations should be documented in the ER.

In support of NRC's responsibility to consider the conformity of its actions with the SIPs, the licensee should provide the following information.

1. Reference the estimates of the monthly incremental onsite work force associated with refurbishment that were reported in Section 3.4. If there will be no refurbishment or if refurbishment involves no additional workers, no further analysis is required.
2. Identify the positions of nonattainment and maintenance areas relative to the plant and probable areas where workers involved with refurbishment activities associated with license renewal will reside. Note the likely commuter routes for the workers. If there are no nonattainment and maintenance areas within 80 km (50 mi) of the plant and residential

¹³ An area is designated "nonattainment" for a criteria pollutant if it does not meet NAAQS for the pollutant. A maintenance area has been redesignated by a State from nonattainment to attainment; the State must submit to EPA a plan for maintaining NAAQS as a revision to its SIP.

Direct emissions are those emissions caused by or initiated by the Federal action that occur at the same time and place as the action. Indirect emissions are those caused by the Federal action that occur later in time or are located away from the action itself. Only those direct and indirect emissions that are reasonably foreseeable and that the Federal agency can practicably control need be considered. It must also be possible to locate and quantify direct and indirect emissions at the time a conformity determination is made. The Federal agency is not obligated to account for possible emissions that might result from the Federal action but cannot be specifically identified, quantified, or located.

¹⁴ Note that the final rule issued by EPA implementing the new statutory requirements for this provision (58 FR 63214) only requires that Federal agencies prepare a written conformity analysis and determination for proposed actions in NAAQS nonattainment or maintenance areas. However, proposed actions near nonattainment or maintenance areas may also cause or contribute to nonattainment. Therefore, 10 CFR 51.53(c)(3)(ii)(F) states that the ER should address this issue for facilities located either in or near a nonattainment or maintenance area, and EPA staff have indicated that in the future they may revise the EPA rule similarly. This approach reflects the reality that emissions continue beyond geographical boundaries and is consistent with environmental impact assessments prepared for NEPA.

locations of refurbishment workers, this should be explained in the ER, and no further analysis is required.

3. Identify the pollutant or pollutants for which the area is in nonattainment or maintenance, as well as the severity of nonattainment.
4. Determine the meteorological conditions typically associated with poor air quality in each nonattainment and maintenance area.
5. Compare the meteorological conditions associated with poor air quality with regional climatology.
6. Estimate onsite and offsite vehicle emissions resulting from refurbishment activities that contribute to the pollutants identified in Step 3 (EPA's handbook AP-42, "Compilation of Air Pollutant Emission Factors," is a good reference), 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 refurbishment worker commuting and other activities directly associated with refurbishment and on EPA emission factors found in the handbook AP-42, *Compilation of Air Pollutant Emission Factors*, Vol. 2, Appendix H, "Highway Mobile Source Emission Factors Tables" (5th Edition, April 3, 1998).¹⁵
7. Determine whether the emissions related to license renewal activities have a reasonable likelihood of adversely affecting air quality in the nonattainment or maintenance area. Climatological considerations, simple atmospheric dispersion models, and conservative assumptions are appropriate for this screening analysis. For each nonattainment and maintenance area determined to have a reasonable likelihood of being adversely affected, continue the analysis in Step 8. No further analysis is required for those areas that were not determined to be adversely affected.
8. **8.a** Compare the total emissions calculated in Step 6 with the appropriate threshold emission levels of 40 CFR 51.853(b). If the threshold emission levels are exceeded, proceed to step 9. If not, continue the analysis at Step 8(b).
8.b Determine the nonattainment or maintenance area's total emissions of pollutants identified in Step 3. These determinations need only be sufficiently accurate to support evaluation of the regional significance of emission levels below the threshold emission levels of 40 CFR 51.853(b). Potential sources of this information include EPA regional offices, State and local air quality agencies, and final EISs. If an existing estimate of the area's total emissions is not found, estimate the emissions from readily available information, such as population, traffic counts, and published emission rates, using reasonable assumptions. Identify the information and the assumptions. Information developed for Section 4.18, Transportation, may be of value in this determination.

¹⁵ Current tables and associated information can be found at the Modeling Page within the EPA Office of Mobil Sources Web site: <http://www.epa.gov/omswww/models.htm>.

8.c Compare the total emissions from refurbishment estimated in step 6 with the area's total emissions estimated in 8(b). In accordance with 40 CFR 51.853(i), if the total emissions from refurbishment are 10% or more of the area's total emissions, proceed to Step 9. If not, the emissions are not regionally significant, and no further analysis is required.

9. For those pollutants identified in Step 8, use air dispersion modeling to estimate pollutant concentrations in the ambient air, which in turn are used to evaluate the extent to which refurbishment-related emission would cause or increase the frequency of exceeding threshold emission levels during the refurbishment.¹⁶ If analyses based on peak employment period emission indicate a potential for exceeding of annual air quality limits, the licensee may account for the fact that the refurbishment period is less than a year and that peak employment levels would not occur during the entire refurbishment period.
10. If refurbishment-related emissions would cause or contribute to exceeding threshold emission levels, the applicant should identify and analyze the extent to which potential mitigation measures would minimize the adverse impact on air quality and should briefly identify the rationale for not implementing any measures that were considered but rejected. Explain the extent to which mitigation measures directed at air quality will be coordinated with mitigation of transportation impacts discussed in Section 4.18.

4.12 Impact on Public Health of Microbiological Organisms

With regard to public health effects of thermophilic organisms, Table B-1 states

These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically.

Specifically, 10 CFR 51.53(c)(3)(ii)(G) requires that

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than 3.15×10^{12} ft³/yr (9×10^{10} m³/yr), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

Plants that use cooling ponds, lakes, canals, or small rivers [i.e., plants that have an annual average flow rate of less than 3.15×10^{12} ft³/year (9×10^{10} m³/year)] to receive their thermal discharge have a potential to enhance the concentration of thermophilic microorganisms. These include the enteric pathogens *Salmonella* sp. and *Shigella* sp., as well as *Pseudomonas aeruginosa*, thermophilic fungi, *Legionella* sp. 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.

¹⁶ Conditions on air quality models used for conformity analysis are contained in 40 CFR 51.859(c).

Information and Analysis Content

If the applicant can show that its plant does not use cooling ponds, lakes, canals, or small rivers to receive its thermal discharge, this fact should be noted in the ER and no further information or analysis is needed. If the plant does use cooling ponds, lakes, canals, or small rivers to receive its thermal discharge, the ER should include the following.

1. The State agency responsible for environmental health should be consulted as to whether there is a concern about the potential existence and concentration of *N. fowleri* in the receiving waters for plant cooling water discharge. The results of this consultation should be documented in the ER.
2. If the State advises that tests should be conducted for concentration of *N. fowleri* in the receiving waters, the tests should be performed when the facility has been operating at a power level typical of the level anticipated during the license renewal period for at least a month to ensure a steady state population during the sampling. Samples should be taken at locations of potential public use.
3. An evaluation of the data should be performed and a determination made of the magnitude of potential impacts of *N. fowleri* on public health during the license renewal term.
4. Proposed mitigation measures to minimize the exposure to members of the public should be described, if deemed necessary, and the rationale for not implementing any measures that were considered but rejected should be explained.
5. A letter report from the head of the State agency responsible for environmental health stating concurrence with the applicant's risk assessment and the proposed mitigation strategy, if one is required, should be included in the ER.

4.13 Electromagnetic Fields–Acute Effects

Table B-1 reports that

Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site.

Specifically, 10 CFR 51.23(c)(3)(ii)(H) requires that

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.

This issue is discussed in Section 4.5.4.1 of NUREG-1437. It concerns transmission lines built to connect the power plant with the existing transmission system, and reviewed as part of the construction permit. Most transmission lines were designed to be in compliance with the National Electric Safety Code (NESC) recommendations for electric shock hazard.¹⁷ However, unless that utility has had an active program of transmission line management aimed at reviewing changes in the uses of the land in the right-of-way and the operating characteristics of the transmission line, and ensuring compliance with changes in the NESC, the line may not meet current NESC recommendations.

Information and Analysis Content

If the transmission lines that were built to connect the plant to the transmission system meet current NESC clearance standards, the applicant should demonstrate that fact in the ER. The demonstration should take one of two forms: (1) a description of an ongoing program of power line right of way supervision and management aimed at ensuring that current electrical shock provisions of the NESC are met, or (2) a transmission line survey that develops the following information.

1. Identification of any sites or areas that do not meet current NESC clearance standards, and any that may not meet the standards after anticipated changes in transmission line operations or reasonably foreseeable changes in land use in the right of way.
2. Maps, photographs, or drawings indicating the locations of all sites that do not meet the NESC clearance standards.
3. For those sites where transmission line characteristics, clearances, and human uses of the transmission corridor may not meet current NESC standards, provide a description of 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. 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 m above ground, the predicted electrical field strength(s) at the edge of the right-of-way in kilovolts per meter (kV/m), and the design bases for these values.
4. For any sites that will not meet NESC clearance standards, provide a detailed explanation of the rationale for concluding that the standards are not appropriate to the situation or the rationale for not making modifications to meet the standards.

4.14 Housing Impacts

Table B-1 concludes that

¹⁷ The National Electric Safety Code®, 1997 Edition, by the Institute of Electrical and Electronics Engineers, Inc., New York (1996). Section 23 deals with clearances. Section 232 deals specifically with clearances between above ground-conductors and human activities, equipment, and structures.

Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the work force associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development.

Specifically, 10 CFR 51.53(c)(ii)(I) requires in part that

An assessment of the impact of the proposed action on housing availability . . . within the vicinity of the plant must be provided.

This issue is discussed in Section 3.7.2 (Refurbishment) and Section 4.7.1 (License Renewal Term) of NUREG-1437.

Impacts to housing availability result when the demand for housing, caused by the project-related population increase, approaches or exceeds the number of available housing units in the vicinity of the plant. The magnitude of the impact will be determined by the number of additional workers associated with refurbishment activities or continued operation and maintenance, and by the population and housing inventory within the region. Cumulative housing impacts result when the project-associated demand for housing combined with other anticipated increases in demand together approach or exceed the number of available housing units.

Information and Analysis Content

The ER should contain the following.

4.14.1 Refurbishment

- 1.** Reference the estimates of the monthly incremental onsite work force associated with refurbishment, reported in Section 3.4. If there will be no refurbishment or if refurbishment involves no additional workers then there will be no impact on housing and no further analysis is required.
- 2.** Reference the number of in-migrating incremental refurbishment workers and their dependents, and the anticipated residential distribution, reported in Section 3.4.
- 3.** Using the regional demographic information from Chapter 2, determine whether the plant is in a region of low, medium, or high population. This determination can be made using Figure C.1, "Population categories, by sparseness and proximity," and Table C.1, "Sparseness and proximity measures used to classify potential case study sites," from Volume 2 of NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Appendices," May 1996. If the region is one of medium or high population where there are not growth control measures that limit housing development, housing impacts are expected to be of small significance. If these conditions are met, and if the number of additional on-site workers associated with refurbishment for

both license renewal and current term operation and refueling does not exceed the peak work force estimate of 2,273 persons used for the socioeconomic impact analysis reported in Section 3.7 of NUREG-1437, the finding of “small significance” may be adopted without further analysis.

4. If the conditions specified in number 3 above are not met, proceed with assessing the following information from Chapter 2: Ongoing and anticipated population change and economic development that could affect housing characteristics in the region or could contribute to cumulative impacts during the period of refurbishment. This information should be available from regional and local sources (e.g., government officials, planning and economic development agencies, realtors).
5. From Chapter 2, reference the number, type, and location of housing units in the region. Reference should be made to housing types (e.g., owner occupied, rental units, hotels or motels, trailer parks), vacancy rates, and turnover. Information from local sources (e.g., government officials and realtors) about housing characteristics should supplement the current decade U.S. Census data.
6. Based on the information above, make an assessment of the potential for impacts to housing availability, comparing the projected incremental demand for housing associated with the refurbishment and refueling related population increase to the stock of available housing in the area. The assessment should consider the magnitude of potential impacts in terms of housing availability,¹⁸ inflation, and changes in housing stock.
7. Describe mitigation measures to avoid or minimize potential adverse impacts. The range of mitigation measures considered and the type of mitigation proposed should be commensurate with the potential magnitude and duration of the impacts. Mitigation might include, at a minimum, hiring workers from the local area to the greatest extent possible. Mitigation of large impacts could include developing trailer pads or supplying temporary housing (e.g., mobile housing) on the site. The development and selection of appropriate mitigation measures should involve discussion with local government officials. The applicant should assess the effectiveness of the mitigation measures at reducing the potential impacts and should briefly explain the rationale for not implementing any measures that were considered but rejected.

4.14.2 License Renewal Term

1. Reference the estimates of the additional onsite work force during the license renewal term that were reported in Section 3.4. If additional workers are not anticipated there will be no impact on housing and no further analysis is required.

¹⁸ The following general thresholds for impact significance are provided as guidance. Site-specific factors may require some flexibility in their application. Additional guidance is provided in Section 3.7.2 of NUREG-1437. Generally, small impacts result when projected demand for housing would lower the vacancy rate for rental or for-sale dwellings by <1 percentage point (e.g., a change from a 5% vacancy rate to a 4% vacancy rate), with rental and for-sale vacancy rates remaining above 2%. Moderate impacts result when projected demand for housing reduces rental and for-sale vacancy rates ≥ 1 but <5 percentage points, with overall vacancy remaining $>1\%$. Large impacts result when projected demand would cause rental or for-sale vacancy rates to drop by ≥ 5 percentage points or to drop to $\leq 1\%$.

2. Reference the number that were reported in Section 3.4 of in-migrating incremental workers estimated for the license renewal term and their dependents and their predicted residential distribution.
3. If the conditions specified in Item 3 in 4.14.1 above are met, replacing the peak number of additional onsite workers associated with refurbishment with the number of additional onsite workers during the license renewal term, then the finding of “small significance” may be adopted for the license renewal term without further analysis.
4. If the conditions specified in Item 3 immediately above are not met, assess the following information from Chapter 2: Ongoing and anticipated population change and economic development that could affect housing characteristics in the region or could contribute to cumulative impacts during the period of refurbishment. This information should be available from regional and local sources (e.g., government officials, planning and economic development agencies, realtors).
5. From Chapter 2, reference the number, type, and location of housing units in the region. Reference should be made to housing types (e.g., owner occupied, rental units, hotels or motels, trailer parks), vacancy rates, and turnover. Emphasis should be on housing trends and projections that extend into the license renewal term. Information from local sources (e.g., government officials and realtors) about housing characteristics should supplement the current decade U.S. Census data.
6. Based on the information above, assess the potential for impacts to housing availability, comparing the projected incremental demand for housing associated with license renewal term-related population increase to the projected stock of available housing in the area. The assessment should consider the magnitude of potential impacts in terms of housing availability,¹⁸ inflation, and changes in housing stock.
7. Describe mitigation measures to avoid or minimize potential adverse impacts. The range of mitigation measures considered and the type of mitigation proposed should be commensurate with the potential magnitude and duration of the impacts. Mitigation might include, at a minimum, hiring workers from the local area to the greatest extent possible. Mitigation of large impacts could include developing trailer pads or supplying temporary housing (e.g., mobile housing) on the site. The development and selection of appropriate mitigation measures should involve discussion with local government officials. The applicant should assess the effectiveness of the mitigation measures for reducing the potential impacts and should briefly explain the rationale for not implementing any measures that were considered but rejected.

4.15 Public Utilities: Public Water Supply Availability

Table B-1 concludes that

An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability.

Specifically, 10 CFR 51.53(c)(ii)(I) requires in part that

. . . [T]he applicant shall provide an assessment of the impact of population increases attributable to the proposed project on the public water supply.

This issue is discussed in Section 3.7.4.5 (for refurbishment) and in Section 4.7.3.5 (for operation) of NUREG-1437.

Information and Analysis Content

The ER should include the following information.

1. The information developed for Section 3.4 on the work force, in-migrating population, and residential location associated with refurbishment and with the renewal period.
2. If water used at the plant is provided by a water utility, identify anticipated increases in the amount of water used during refurbishment and during the renewal term.
3. For each water utility service area that may be affected, provide information on the capacity and utilization rate of the public water system projected to exist at the time of peak refurbishment work force, as well as capacity and cumulative utilization rate caused by general population increase during the renewal period. Document discussions with the potentially affected water utilities as to whether the projected population increase will stress the water supply or require an increase in capacity.
4. If the water supply will be stressed as a result of refurbishment or operation during the renewal period, identify, in coordination with the water utility, what mitigating measures would be appropriate. Describe these measures and state which, if any, will be taken. Briefly explain the rationale for not implementing any measures that were considered but rejected.

4.16 Education Impacts from Refurbishment

Table B-1 states that

Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors.

Specifically, 10 CFR 51.53(c)(ii)(I) requires in part that

An assessment of the impact of the proposed action on . . . public schools (impacts from refurbishment activities only) within the vicinity of the plant must be provided.

This issue is discussed with regard to plant refurbishment in Section 3.7.4.1 of NUREG-1437. Section 4.7.3.1 of NUREG-1437 placed this issue in Category 1 for the license renewal period.

Impacts to education are a product of (1) the additional demand on the public education system resulting from the refurbishment-related population growth and (2) the capacity of the education system to absorb additional students. The capacity of the system to absorb additional students is related to the size of the school system (i.e., larger school systems typically can absorb more students than smaller systems) and whether the system already is experiencing growth pressures. Section 3.7.4.1 of NUREG-1437 includes definitions of small, moderate, and large impacts to education.¹⁹ Cumulative impacts can result if the project-related demand for education, coupled with demand associated with other ongoing economic development or with changes in the level of service (e.g., resulting from changes in fiscal policy), affects the school system's ability to provide educational services.

Information and Analysis Content

The analysis of potential effects on education in the ER is to include the following information.

1. The information developed for Section 3.4 on the incremental work force, in-migrating population, the number of school-age children, and their residential locations during the refurbishment period.
2. For each school system that may be affected, information on the classroom capacity and student-teacher ratio projected to exist at the time of peak refurbishment work force. Document discussions with the potentially affected school systems as to whether the projected increase in students will stress the capacity of the school system.
3. If educational resources will be stressed by the additional students during the refurbishment period, identify, in coordination with the school officials, what mitigation measures would be appropriate. Describe these measures and state which, if any, will be taken. Briefly explain the rationale for not implementing any measures that were considered but rejected.

4.17 Offsite Land Use

4.17.1 Refurbishment

Table B-1 concludes that

Impacts may be of moderate significance at plants in low population areas.

Specifically, 10 CFR 51.53(c)(ii)(I) requires in part that

¹⁹ Section 3.7.4.1 states: "In general, small impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts generally are associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service. . . . Large impacts are associated with project-related enrollment increases above 8 percent."

An assessment of the impact of the proposed action on . . . land-use . . . within the vicinity of the plant must be provided.

This issue is discussed in Section 3.7.5 of NUREG-1437, in which general standards are provided for determining the magnitude of land-use impacts.²⁰ The phrase “vicinity of the plant” used in the regulation and the phrase “study area” used in this footnote are synonymous. This area is generally defined as the host county and municipality, as well as other counties or municipalities in which a substantial segment of the in-migrating population would be expected to reside.

Impacts to off-site land use result when the development pressures resulting from the project-related population increases result in changes to local land-use and development patterns. Development pressures are closely tied to population increase impacts on housing covered in Section 4.14. These changes can have either positive or negative impacts, depending upon the value attributed to land-use changes by different individuals and groups. Cumulative land-use impacts result when the project-associated population growth, combined with other population growth and land-use pressures, induces changes to local land-use and development patterns.

Information and Analysis Content

The information and analyses developed in this section should build from the information and analyses developed in Section 3.4 and Section 4.14 relevant to the period of refurbishment. If there will be no additional workers due to refurbishment, there will be no impact on land-use and no further analysis is required. If the population and growth control criteria given in Section 4.14 resulted in a determination that “. . . the impact on housing is expected to be minor and no further analysis of project-specific impacts to housing is required,” it is likely that offsite land-use impacts will also be minor. In any case, further screening for land-use impacts is appropriate. If the applicant can demonstrate the validity of the following three conditions, it may be concluded that the effects of refurbishment-related population growth on land-use and development patterns will be small, and no further analysis is needed.

- (1) Project-related population growth (including direct and indirect workers and their families), when added to other anticipated or reasonably foreseeable population growth, would not increase existing area population by more than 5 percent.
- (2) The project area has established development patterns. Established development patterns are indicated if the community has established land use controls or infrastructure in place to support reasonably foreseeable development.

²⁰ In Section 3.7.5 of NUREG-1437 it is stated that:

Generally, if plant related population growth is less than 5 percent of the study area’s total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile (2.6 km²), and at least one urban area with a population of 100,000 or more within 80 km (50 miles).

If refurbishment-related growth is between 5 and 20 percent of the study area’s total population, moderate new land-use changes can be expected. Such impacts would most likely occur when the study area has established patterns of residential and commercial development, a population density of 30 to 60 persons per square mile (2.6 km²), and one urban area within 80 km (50 miles).

... Large impacts were not induced at any site by population growth.

- (3) The project area is not extremely isolated or sparsely populated. Extreme isolation is indicated if the area is more than 50 miles (80 km) from the nearest urban area with a population of 100,000 or more; sparsely populated is indicated if the population density is less than 60/mile² (21/km²) within a 20-mile (32-km) radius from the plant.

If any of these cannot be demonstrated, an assessment of the impact of the proposed action on off-site land use should be provided in the ER.

The assessment should consider the size of the peak incremental labor force (onsite and indirect) associated with the project, the number of workers expected to commute daily, the number expected to migrate to the area and require temporary or permanent housing, the potential demand for new temporary or permanent housing as determined in the analysis of potential housing effects, land-use controls in the area, and the physical infrastructure in place in the area. If refurbishment and refueling workers are to be on-site simultaneously, the analysis should consider the combined work forces. Similarly, the analysis of impacts from post-relicensing refueling and maintenance activities should consider potential effects of the total number of temporary refueling/maintenance workers. Section 3.7.5 of NUREG-1437 provides definitions of small, moderate, and large land-use impacts.

Information in the ER for the analysis of potential effects on land use should include the following.

1. The information and analysis developed in Section 4.14.1 should be referenced.
2. A description of land-use controls, zoning, or restrictions in the area, including reasonably foreseeable future changes.
3. A description of land-use patterns in the area, including the scale and type of commercial development and the housing stock (see Section 4.14.1).
4. A description of existing and planned infrastructure (including gas, water, sewer, and power lines and roads).
5. An analysis of the potential for population changes arising from refurbishment to cause changes in patterns of land use. If potential changes in land use are identified, assess their significance. Document discussions with local planning authorities as to their assessment of the significance of any changes in patterns of land use.
6. If the local planning authorities believe the potential changes in land use are significant, identify, in coordination with the authorities, mitigation measures that would be appropriate. Describe these measures and state which, if any, will be taken and briefly explain the rationale for not implementing any measures that were considered but rejected.

4.17.2 License Renewal Term

Table B-1 states

Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal.

Specifically, 10 CFR 51.53(c)(3)(ii)(I) requires, in part, that

An assessment of the impact of the proposed action on . . . land-use . . . within the vicinity of the plant must be provided.

This issue is addressed in Section 4.7.4 of NUREG-1437. The specifics of the magnitude of land-use change and impact predictor criteria, and the definition of the term “vicinity of the plant,” are as given in Section 4.17.1 of this guide. Table B-1 of 10 CFR Part 51 partially misstates the conclusion reached in Section 4.7.4 of NUREG-1437. Section 4.7.4 concludes that “population-driven land-use changes during the license renewal term at all nuclear plants will be small.” A Category 2 finding for land-use changes during the license renewal term was made because of potential tax-driven land-use changes and the inability to reach a generic conclusion as to whether communities would see such changes as negative or positive. Until Table B-1 is changed, applicants need only cite NUREG-1437 to address population-induced land-use change during the license renewal term.

During the license renewal term, new land-use impacts could result from plant-related population growth or from the use of tax payments from the plant by local government to provide public services that encourage development. The resulting changes can have either positive or negative impacts, depending upon the value attributed to land-use changes by different individuals and groups. Cumulative land-use impacts result when tax revenues generated by the plant combine with land-use pressures (e.g., rapid, unexpected population growth) to induce changes to local land-use and development patterns.

Information and Analysis Content

The assessment should consider the size of the plant-generated revenues relative to the total revenues of the taxing jurisdictions, land-use controls in the area, and the physical infrastructure in place in the area.

Information for the analysis of potential effects on land use includes the following.

1. The information and analyses developed in Section 4.14.2 should be referenced.
2. A description of land-use controls, zoning, or restrictions in the area, including reasonably foreseeable future changes.
3. A description of land-use patterns in the area, including the scale and type of commercial development and the housing stock (see Section 4.14.1).
4. A description of existing and planned infrastructure (gas, water, sewer, and power lines, roads).

5. An estimate of the tax or other revenue to be paid to local governmental jurisdictions during the license renewal term (considering all tax payments by the plant—not just the increment arising from refurbishment-related improvements—whether paid directly to local jurisdictions or indirectly through State tax revenue-sharing programs). Relevant jurisdictions include the State, city, county, school district, or other special purpose districts in which the plant is located.
6. The total revenue for the current year of the taxing jurisdictions and an estimate of total revenue during the plant’s license renewal term.
7. If potential changes in land use are identified, assess their significance. Discuss with local planning authorities whether tax revenue changes during the license renewal term will cause land-use changes in their jurisdiction. Document discussions with local planning authorities as to their assessment of the significance of any anticipated changes in patterns of land use.
8. If the local planning authorities believe the potential changes in land use are significant, identify, in coordination with the authorities, mitigation measures that would be appropriate. Describe these measures and state which, if any, will be taken and briefly explain the rationale for not implementing any measures that were considered but rejected.

4.18 Transportation

Table B-1 states that

Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites.

Specifically, 10 CFR 51.53(c)(ii)(J) requires that

All applicants shall assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license.

These impacts are addressed in Sections 3.7.4.2 and 4.7.3.2 of NUREG-1437.

Transportation impacts are related to the total size of the work force and to the prevailing road and traffic conditions at the time of the project. Transportation effects result when project-related traffic induces a change in the level of service (LOS)²¹ such that LOS of C or higher occurs on highway segments or intersections in the vicinity of the plant. Section 3.7.4.2 states that

²¹ Level of service is defined in Section 3.7.4.2 of NUREG-1437. See also Transportation Research Board, *Highway Capacity Manual*, Special Rpt 209, National Research Council, Washington, DC, 1985.

LOS A and B are associated with small impacts because operation of individual users is not substantially affected by the presence of other users. At this level, no delays occur and no improvements are needed. LOS C and D are associated with moderate impacts because the operation of individual users begins to be severely restricted by other users, and at level D small increases in traffic cause operational problems. Consequently, upgrading of roads or additional control systems may be required. LOS E and F are associated with large impacts because the use of the roadway is at or above capacity level, causing breakdowns in flow that result in long traffic delays and potentially increased accident rates. Major renovations of existing roads or additional roads may be needed to accommodate the traffic flow.

NUREG-1437 defines small, moderate, and large impacts to transportation in Section 3.7.4.2. Cumulative transportation impacts are the result of project-related traffic increases coupled with traffic increases resulting from other activities (e.g., other large construction projects or new economic development) in the area. Although plant-related traffic will use highway segments not in the vicinity of the plant, such traffic likely will be dispersed over a number of roads. Highway segments and intersections that are a considerable distance from the plant may need to be assessed if the majority of project-related traffic will flow through them.

Information and Analysis Content

The information to analyze potential impacts to transportation includes the following.²²

1. From the refurbishment and license renewal term employment information provided in Section 3.4, "Employment," estimate the daily traffic associated with refurbishment activities and with the license renewal term. The estimate should include commuting workers (including refueling workers if the refueling and refurbishment activities will occur simultaneously) and shipments of materials. The effect of carpooling and the availability and use of public transportation should be considered in the estimate. Peak traffic times should be determined or estimated.
2. A forecast, for both periods, of the highway segments and interchanges likely to be affected by the increased traffic, inferred from current traffic patterns associated with operations and refueling workers.
3. Information on recent LOS, capacity, and usage for highway segments and intersections forecast to be impact areas. State or county departments of transportation typically maintain these data.
4. Information from local sources (e.g., government officials, planning and economic development agencies) about ongoing and anticipated economic development (e.g., new construction or industry in the area of the plant) and changes in road conditions that could affect LOS and be a contributor to cumulative impacts.

²² The information required for assessment of the transportation issue is much the same as some of the information required for the assessment of the air quality issue, in Section 4.11 of this guide.

5. Based on this information, the applicant, for both periods, should project the volume of project-related traffic likely to occur at each segment, calculate the increase in traffic on affected highway segments and intersections, and project the LOS that would result during peak periods on each segment. Consultation with local and State departments of transportation, who often have guidelines about how LOS is affected by an increase in traffic volume given specific road conditions, should facilitate the LOS determination. The analysis and the resulting LOS for each segment or intersection considered should be documented in the ER.
6. A discussion of potential mitigation measures, commensurate with the projected level of impact, should be included in the ER. Mitigation measures could include, for example, adjusting shift change time to nonpeak traffic times, busing, or road and traffic control improvements. The applicant should estimate the potential effect of the mitigation measures, include this assessment in the ER, and briefly explain the rationale for not implementing the measures that were considered but rejected.

4.19 Historic and Archaeological Resources

Table B-1 states that

Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection.

Specifically, 10 CFR 51.53(c)(ii)(K) requires that

All applicants shall assess whether any historic or archaeological properties will be affected by the proposed project.

This issue is discussed in Section 3.7.7 and Section 4.7.7 of NUREG-1437.

The National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470-470w-6, in Section 106, requires that Federal agencies take into account the effects of the agency's undertaking (including issuance of a license) on properties included in or eligible for the National Register of Historic Places and, prior to approval of an undertaking, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. The procedure for meeting Section 106 requirements is defined in regulations of the Advisory Council, "Protection of Historic Properties" (36 CFR Part 800). The guidance that follows instructs the applicant as to the information and analysis that is required for the NRC to comply with Section 106 requirements in a manner that minimizes the potential for the consultation process with the Advisory Council to delay review of the application. The applicant should also consider the effects on properties that are not eligible for the National Register of Historic Places but, nevertheless, are likely to be

considered by the State Historic Preservation Officer or local historians to have local historic value and to contribute substantially to an area's sense of historic character.²³

Information and Analysis Content

The ER should include the following information.

1. From Chapter 3 of this guide, identify those refurbishment and license renewal term activities that could affect onsite or offsite historic properties.²⁴ Such activities would include ground disturbing activity, increases in traffic, and audio and visual intrusions.
2. On a copy of the site map or, if appropriate, the site vicinity map included in Chapter 2, identify the areas of potential effects if historic properties were to be found.
3. On the map, identify historic properties that may be affected. All on-site historic properties and any off-site historic properties located in or near areas of potential effects should be identified. These properties should be described in the text. Properties can be identified by referring to the "National Register of Historic Places," 36 CFR Part 60; consultation with the State Historic Preservation Officer (SHPO), local preservation officials, and nearby Native American Tribal officials; and field surveys.
4. If historic properties are found in or near areas of potential effects, assess those effects. Criteria of effect and adverse effect are given in 36 CFR 800.9. Applicants are encouraged to involve the SHPO and local historic preservation officials in the assessment. The assessment should lead to one of three conclusions.
 1. No effect: the undertaking will not affect historic properties;
 2. No adverse effect: the undertaking will affect one or more historic properties, but the effect will not be harmful;
 3. Adverse effect: the undertaking will harm one or more historic properties.
5. If an adverse effect will occur, the applicant, in consultation with the SHPO and other interested parties should identify measures to make the refurbishment or license renewal term activities less harmful.

4.20 Severe Accident Mitigation Alternatives

Table B-1 states that

²³ This criterion is a NEPA consideration, not related to NHPA requirements.

²⁴ Historic property is defined in 36 CFR 800.2(e): "Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register. This term includes, for the purposes of these regulations, artifacts, records, and remains that are related to and located within such properties. The term 'eligible for inclusion in the National Register' includes both properties formally determined as such by the Secretary of the Interior and all other properties that meet National Register listing criteria." National Register criteria for listing are found in 36 CFR Part 60.

The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, 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 that

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.

Severe accident mitigation alternatives are discussed in Section 5.4 of NUREG-1437.

The analyses performed for Chapter 5, "Environmental Impacts of Postulated Accidents," of NUREG-1437 represent adequate, plant-specific estimates of the environmental impacts of severe accidents. However, the Commission determined that a site-specific consideration of severe accident mitigation alternatives (SAMAs) will be required at the time of license renewal unless a previous consideration of such alternatives regarding plant operation has been included in a final environmental impact statement, or final environmental assessment, or a related supplement. The applicant should provide the relevant citation. If no such citations exist, the applicant should provide the following information.

Information and Analysis Content

The identification of possible SAMAs and evaluation of their merits should use the information and analyses developed for the plant-specific individual plant examination (IPE) for severe accident vulnerabilities (and modifications made subsequent thereto) and, when available, the plant-specific individual plant examination of external events (IPEEE) for severe accident vulnerabilities (e.g., earthquakes, fires, winds). If an IPEEE has not been completed, the applicant may use the results of IPEEEs performed for other plants, adjusted for plant-specific variables. In preparing the SAMA analyses, applicants may be guided by analyses performed for previous applications for renewal of operating licenses and by the NRC for Watts Bar Unit 1 Nuclear Power Plant, NUREG-0498, Supplement 1, "Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2," April 1995,² and supplements to NUREG-1437.² In structuring the analysis, the applicant should consider the methodology presented in NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," January 1997.²

The results of the following analytical steps should be presented in the ER, and the methodology or analytical process should be described.

1. Based on the plant-specific risk study and supplementary analyses, identify and characterize the leading contributors to core damage frequency and offsite risk (i.e., population dose). The frequency and contributors to core damage frequency and large release frequency are generally available from the plant-specific risk study, such as the IPE. 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 IPEEE and any other external event analyses, provide estimates of the incremental contribution to dose consequence risk identified from the IPE.
3. Identify practical physical plant modifications and plant procedural and administrative changes that can reduce severe accident dose consequence risk. 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. A detailed discussion of calculating values is found in Chapter 5 of NUREG/BR-0184.
5. Estimate the approximate cost of each modification and procedural and administrative change found to reduce the dose consequence risk of severe accidents. Potential SAMAs that are not expected to be cost beneficial, even when uncertainties in the analysis (e.g., a factor of 10) are taken into consideration, may be screened out based on a bounding analysis.
6. Perform a more detailed value-impact analysis for remaining SAMAs to identify any plant modifications and procedural changes that may be cost effective (see Chapter 5 of NUREG/BR-0184).
7. List plant modifications and procedural changes (if any) that have or will be implemented to reduce the severe accident dose consequence risk.

4.21 Transportation of Radiological Waste

This is a Category 1 issue and the impacts are small as long as the fuel used is not enriched beyond 5 percent uranium-235 and average burnup for the peak rod does not exceed 62,000 Mwd/MTU.

Table B-1 states that

The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in Summary Table S-4—Environmental Impact of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental values reported in Sec. 51.52.

This issue is discussed in Section 5.4 and Section 5.5.2.5 of NUREG-1437, which has been updated by 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,”²⁵ August 1999.

Addendum 1 provided the technical basis to the final rule, 64 FR 48496, September 3, 1999, that changed the transportation of fuel and waste from a Category 2 issue to Category 1. The staff is closely monitoring industry and NRC programs that would lead to fuel burnup higher than 62,000 MWd/MTU to modify the September 3, 1999, rule in a timely manner. Meanwhile, any potential applicant for license renewal seeking approval for burnup beyond 62,000 MWd/MTU should request early guidance from the NRC staff on how to handle this issue in the ER.

4.22 Environmental Justice

Table B-1 states that

The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.

Environmental justice was not reviewed in NUREG-1437. Executive Order 12898, “Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations,” issued on February 11, 1994, is designed to focus the attention of Federal agencies on the human health and environmental conditions in minority and low-income communities.²⁵ The NRC Office of Nuclear Reactor Regulation (NRR) is guided in its consideration of environmental justice by Attachment 4, “NRR Procedures for Environmental Justice Reviews,” to NRR Office Letter No. 906, Revision 2, “Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues,” September 21, 1999. NRR Office Letter No. 906 is revised periodically. The environmental justice review involves identifying off-site environmental impacts, their geographic locations, minority and low-income populations that may be affected, the significance of such effects and whether they are disproportionately high and adverse compared to the population at large within the geographic area, and if so, what mitigative measures are available, and which will be implemented. The NRC staff will perform the environmental justice review to determine whether there will be disproportionately high human health and environmental effects on minority and low-income populations and report the review in its SEIS. The staff’s review will be based on information provided in the ER and developed during the staff’s site-specific scoping process.

Information and Analysis Content

The ER should include the following information to assist the staff in its environmental justice review.

- 1.** From Chapter 2, provide by political jurisdiction the composition of minority and low-income persons within 80 km (50 miles) of the plant. Migrant workers as well as full time

²⁵ Minority categories are defined as Black/African American; American Indian, Eskimo, or Aleut; Asian or Pacific Islander; other non-white; and Hispanic origin. Low-income is defined as being below the poverty level as defined by the Bureau of the Census.

residents should be included. Provide these data by census tract/block for those geographic areas where the potential has been identified in Chapter 4 for adverse impacts from refurbishment and from continued operation during the renewal term. The most recent Bureau of the Census demographic information should be supplemented with demographic information from State and local planning agencies.

2. Identify in Chapter 4, Chapter 5, and Chapter 6 the geographic location of each environmental impact and proposed mitigating action addressed.

CHAPTER 5. ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

The regulatory requirement to report new and significant information of which the applicant is aware and the definition of new and significant information is discussed in the “General Guidance” section in the Introduction of this regulatory guide. While the identification of new and significant information may result from the scoping process (including the staff’s site visit) and from public comments on the draft SEIS, it is appropriate for the applicant to identify any new and significant information early. To achieve early identification, the NRC encourages the applicant, as it develops the ER, to employ methods that will reveal potential new and significant information. To the extent the following information exists, it should be summarized in this chapter of the ER.

1. Describe the information gathering and review process used in developing this ER. Explain how the process would result in the identification of new and significant information concerning Category 1 issues and issues not listed in Appendix B to Subpart A of 10 CFR Part 51. The explanation should address (1) the methods used by the applicant that will make it cognizant of new information, if it exists, and (2) the process for evaluating the significance of new information, if found. Examples of means for identifying new information include review of environmental monitoring results, review of related scientific literature, surveys of the applicant’s environmental and operations staff, exchange of information among licensees through peer groups and industry organizations, consultations with academicians knowledgeable of the local environment, and consultations with Federal, State, Tribal, and local environmental, natural resource, permitting, and land use agencies. The description of the review process for evaluating new information for significance should include the organizational procedures for handling reports of new information and the criteria used to determine the applicability of such information. An applicant who is not cognizant of any new and significant information should so state in the ER.
2. Describe any new and significant information identified and the associated environmental impacts.
3. For each impact, describe mitigation measures that were considered and the measures that will be implemented.

Detailed supporting documentation need not be included in the ER, but should be available for review by the NRC. Supporting documentation may include (1) a general description of the participants involved, their organizational affiliations, how they interact among themselves, and the role that they served in the process; (2) a description of consultations with academicians and

Federal, State, Tribal, and local environmental natural resource, permitting, and land use agencies; and (3) a description of new information that was identified and the assessment of its significance.

CHAPTER 6. SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

This section should provide a summary, preferably in tabular form, of the environmental impacts related to license renewal for the plant. The summaries should be descriptive and informative rather than evaluative or comparative. The presentation of material should be organized by environmental resource area, such as the subject areas used in Table B-1.

6.2 Mitigation

This section should provide a summary, preferably in tabular form, of each mitigative action committed to in this 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). Unavoidable adverse effects should be identified in Chapters 4 and 5, in detail commensurate with the significance of the effects.

6.4 Irreversible or Irrecoverable Resource Commitments

This section should summarize “any irreversible or 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 or irretrievable commitments of resources include energy and materials consumed, resources and materials committed over the license renewal term, and additional waste materials that will be generated by extended operations. In addition to summarizing irreversible and irretrievable resource commitments discussed in Chapters 4 and 5, this section should briefly describe the magnitude and significance of irreversible or irretrievable commitments of resources that are not addressed in those sections. 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 may be taken to mean the operating life of the plant and long-term should be taken to be the period beginning after the end of its licensed operating life and continuing as long as the past operations of the plant could have discernible impacts. For refurbishment impacts, short-term may be taken to include the refurbishment period

and long-term may be taken to be the period beginning with the completion of refurbishment. Long-term should be interpreted in the context of the nature of the affected resource. For some resources, there may be no long-term impacts, such as those affected by refurbishment or operations that return to normal conditions after operations cease). For other resources, there may be only long-term impacts, such as global warming impacts of increasing or reducing combustion of fossil fuels.

The discussion should recognize that license renewal may have both adverse and beneficial impacts on the long-term productivity of the environment. 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 humankind.

Chapter 7. ALTERNATIVES TO THE PROPOSED ACTION

Regarding alternatives, 10 CFR 51.53(c)(2) states in part that

. . . [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.

Requirements for the treatment of alternatives in an EIS are presented in Section 5 of Appendix A to Subpart A of 10 CFR Part 51. These requirements are consistent with the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1502.14), which require that an EIS²⁶

- (a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
- (b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.
- (c) Include reasonable alternatives not within the jurisdiction of the lead agency.
- (d) Include the alternative of no action.
- (e) 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.
- (f) Include appropriate mitigation measures not already included in the proposed action or alternatives.

²⁶ Additional guidance on alternatives is provided by CEQ’s “Forty Most Asked Questions Concerning CEQ’s National Environmental Policy Act Regulations” (46 FR 18026, March 23, 1981, and as amended 51 FR 15618, April 25, 1986).

In deciding whether or not to approve license renewal, the NRC will consider the environmental impacts of alternatives as well as those of the proposed action. The NRC considers environmental effects of license renewal according to 10 CFR 51.103(a)(5).

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 No-Action Alternative

For license renewal, the no-action alternative is defined as the alternative of not renewing the license. At license expiration, plant operations would terminate and decommissioning activities would commence. The environmental impacts of terminating nuclear power plant operations and decommissioning are discussed in Section 8.4 of NUREG-1437. The ER should contain an analysis of the no-action alternative, including impacts on land use, water quality, air quality, ecological resources, human health, social and economic structure, waste management, aesthetics, and cultural resources. Direct, indirect, and cumulative impacts should be considered. The level of effort expended on impact analyses of alternatives should be commensurate with the significance of the impacts. Material from NUREG-1437 may be summarized and incorporated by reference to the extent it is applicable.

7.2 Alternatives that Meet System Generating Needs

7.2.1 Alternatives Considered

The range of alternatives to be considered should be focused by the stated purpose and need for the proposed action. The statement of purpose and need adopted by the NRC and stated in NUREG-1437 and in Chapter 1 of this regulatory guide focuses on meeting future power system generating needs. Alternatives that meet the stated purpose and need are (1) build new generating capacity, (2) purchase the power from outside the system, and (3) reduce power requirements through demand reduction. The ER should demonstrate that the applicant has considered these or similar alternatives. The applicant should identify the criteria used in evaluating the reasonableness of the alternatives and explain which alternatives will not be considered further and why. The ER should identify the alternatives that will be carried forward for comparison with license renewal. The ER should discuss the extent to which these alternatives have been considered by State authorities (e.g., public service commissions and environmental, natural resource, or energy agencies) and how such considerations relate to the applicant's evaluation.

7.2.2 Environmental Impacts of Alternatives

This section should describe the impacts of the alternatives identified for further consideration. The impacts should be described in sufficient detail so that reviewers may compare the adverse and beneficial impacts of the alternatives with those of renewing the operating license. Impact analyses should consider land use, water quality, air quality, ecological resources, human health, social and economic systems, waste management, aesthetics, and cultural resources. 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 long-term productivity of the environment. To the extent possible, each alternative should be analyzed on a site- or region-specific basis. Each impact should be analyzed in proportion to its significance. Chapter 8 of NUREG-1437 includes the results of an analysis of the generic environmental impacts of several electricity generating technologies. These results may be utilized to the extent that they are applicable.

Chapter 8. COMPARISON OF ENVIRONMENTAL IMPACT OF LICENSE RENEWAL WITH THE ALTERNATIVES

This section should present the impacts of the proposed action, the no action alternative, and other reasonable alternatives in comparative form in order to sharply 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.” This comparison may be presented in any of several formats. Often the comparison is presented in a tabular format such as Tables 8.1 and 8.2 of NUREG-1437. The comparison should emphasize the more significant impacts of each alternative.

Chapter 9. STATUS OF COMPLIANCE

According to 10 CFR 51.45(d), an applicant must discuss the status of compliance in the ER.

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 H of Volume 2 of NUREG-1437² summarizes the major Federal statutes that may relate to license renewal applications.

REGULATORY ANALYSIS

A separate regulatory analysis was not prepared for this regulatory guide. NUREG-1440, "Regulatory Analysis of Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses" (May 1996), provides the regulatory basis for this guide. NUREG-1440 was prepared for the amendment to 10 CFR Part 51 with respect to requirements for the environmental review for renewal of nuclear power plant operating licenses, which was promulgated on December 18, 1996 (61 FR 66537). A copy of NUREG-1440 is available for inspection and copying for a fee at the NRC Public Document Room, 2120 L Street NW., Washington, DC 20555-0001; phone (202)634-3273; fax (202)634-3343. In addition, copies may be purchased from the Superintendent of Documents, U.S. Government Printing Office, PO Box 37082, Washington, DC 20013-7082. Copies are also available for purchase from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

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