

1.0 Introduction

By letter dated October 16, 2003, System Energy Resources, Inc. (SERI), a subsidiary of Entergy Corporation (Entergy), submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for an early site permit (ESP) for property co-located with the existing Grand Gulf Nuclear Station (GGNS) near Port Gibson, Mississippi. This application has subsequently been revised by SERI through Revision 2 (SERI 2005). Under NRC regulations in Title 10 of the Code of Federal Regulations (CFR) Part 52, NRC is required to prepare an environmental impact statement (EIS) as part of its review of an ESP application. The NRC regulations implementing the National Environmental Policy Act (NEPA) are found in 10 CFR Part 51. The NRC staff published a notice in the *Federal Register* (68 FR 75656) stating its intent to prepare an EIS, conduct scoping, and publish a draft EIS (DEIS) for public comment as required in 10 CFR 51.26. NRC issued a notice on April 28, 2005 (70 FR 22155) announcing the availability of the DEIS and the time and place of a public meeting to receive comments on the DEIS. The staff considered these comments while developing this final EIS. NRC also prepared a separate safety evaluation report in accordance with 10 CFR Part 52 (NRC 2005).

To distinguish the areas discussed, “Grand Gulf site” refers to the entire 850-ha (2100-ac) property that includes the existing GGNS (Unit 1 and all existing facilities) and the area for the proposed Grand Gulf ESP facility. This document refers to the “Grand Gulf site” for the entire property, “Grand Gulf Nuclear Station (GGNS)” for the existing facilities, and “Grand Gulf ESP facility/site” for the proposed facilities and area.

1.1 Background

An ESP is a Commission approval of a site or sites for one or more nuclear power facilities. The filing of an application for an ESP is a process that is separate from the filing of an application for a construction permit (CP) or combined construction permit and operating license (combined license or COL) for such a facility. The ESP application and review process makes it possible to evaluate and resolve safety and environmental issues related to siting before the applicant makes large commitments of resources. If the ESP is approved, the applicant can “bank” the site for up to 20 years for future reactor siting. In addition, if the ESP includes a site redress plan, the ESP holder could conduct specific site preparation activities allowed by 10 CFR 50.10(e)(1). An ESP does not authorize construction and operation of a nuclear power plant. To construct and operate a nuclear power plant, an ESP holder must obtain an NRC CP and operating license or COL from NRC. Both of these actions would require preparation of an EIS in accordance with 10 CFR Part 51.

As part of its evaluation of the environmental aspects of the action proposed in an ESP application, NRC prepares an EIS in accordance with 10 CFR 52.18. Because site suitability

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encompasses construction and operational parameters, the EIS addresses impacts of both construction and operation of reactors and their associated facilities. In a review separate from the EIS process, the NRC analyzes the safety characteristics of the proposed site and emergency planning information. These latter two analyses are documented in a safety evaluation report (NRC 2005) that presents the conclusions reached by the NRC regarding whether there is reasonable assurance that a reactor or reactors (having characteristics that fall within parameters described by the applicant) can be constructed and operated without undue risk to the health and safety of the public, whether there are significant impediments to the development of emergency plans, and whether site characteristics are such that adequate security plans and measures can be developed. In addition, if the applicant proposes major features of emergency plans, or complete and integrated emergency plans, the safety evaluation report will document whether such major features are acceptable, or whether the complete and integrated emergency plans provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

1.1.1 Plant Parameter Envelope

The applicant for an ESP need not provide a detailed design of a reactor or reactors and the associated facilities, but should provide sufficient bounding parameters and characteristics of these components so that an assessment of site suitability can be made. Consequently, the ESP application may refer to a plant parameter envelope (PPE) as a surrogate for a nuclear power plant and its associated facilities.

The PPE is a set of values of plant design parameters that an ESP applicant expects will bound the design characteristics of the reactor or reactors that might be constructed at a given site. In effect, it serves as a surrogate for actual reactor design information. Use of this PPE approach allows an ESP applicant to defer the selection of a reactor design until the CP or COL stage. The PPE reflects the upper-bound values for each parameter it encompasses rather than the characteristics of any specific reactor design. The PPE is discussed in more detail in Section 3.2 of this EIS.

1.1.2 Site Preparation and Preliminary Construction Activities

The holder of an ESP, or an applicant for a CP (10 CFR Part 50) or COL (Subpart C of 10 CFR Part 52) that references an ESP with an approved site redress plan, may undertake specific site preparation and construction activities allowed by 10 CFR 50.10(e)(1), provided the final EIS for the ESP concludes the activities will not result in any significant adverse environmental impacts that cannot be redressed. SERI has chosen not to include a site redress plan in its application and, therefore, would not be permitted to undertake site preparation activities under this proposed action.

1.1.3 Early Site Permit Application and Review

In accordance with 10 CFR 52.17(a)(2), SERI submitted an ESP application to NRC for property co-located with the existing GGNS near Port Gibson, Mississippi (SERI 2005). The period requested for the ESP was 20 years. SERI's environmental report (SERI 2005) focused on the environmental effects of construction and operation of reactors with characteristics that fall within the PPE (see Appendix I). It also included an evaluation of alternative sites to determine if there is an obviously superior alternative to the proposed site. An ESP environmental report is not required to include a benefits assessment (e.g., the need for power) (10 CFR 52.17) or a discussion of energy alternatives (NRC 2003a); these may be deferred to the CP or COL application. However, the SERI environmental report did address energy alternatives (SERI 2005).

The NRC standards for review of an ESP application are outlined in 10 CFR 52.18. As with the environmental report (SERI 2005), this EIS focuses on the environmental effects of construction and operation of reactors with characteristics that fall within the PPE developed by SERI and includes an evaluation of alternative sites to determine if there is any obviously superior alternative to the proposed Grand Gulf ESP site. Also, this EIS includes an assessment of energy alternatives, but does not address the need for power.

The NRC staff conducts its reviews of ESP applications in accordance with guidance set forth in review standard RS-002, *Processing Applications for Early Site Permits* (NRC 2004). The review standard draws from the previously published NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 1987), and NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, hereafter referred to as Environmental Standard Review Plan (ESRP) (NRC 2000). RS-002 provides guidance to NRC staff reviewers to help ensure a thorough, consistent, and disciplined review of any ESP application. As stated in RS-002, an applicant may elect to use a PPE approach instead of supplying specific design information. The staff's June 23, 2003, responses to comments received on draft RS-002 provide additional insights on the staff's expectations and potential approach to the review of an application employing the PPE approach (NRC 2003b). Specifically, the NRC staff tasked to perform the environmental review has been trained on using the guidance in the ESRP and RS-002, and on incorporating the PPE concept into its review. The reviewers adapted the ESRP review guidance to account for the PPE concept. The findings in this EIS reflect the adaptation of the ESRP guidance to the PPE approach.

In addition, the staff also considered the information and analyses provided in the *Generic Environmental Impact Statement for License Renewal* (NRC 1996) in its review. Because the generic environmental impact statement included a review of data from all operating nuclear

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power plants, some of the information was useful for the environmental review of the proposed action. The staff has identified in the text those areas where this information has been used.

Pursuant to 10 CFR 52.18, an EIS prepared by the NRC staff on an application for an ESP focuses on the environmental effects of construction and operation of a reactor, or reactors, that have characteristics that fall within the postulated site parameters. Such an EIS must also include an evaluation of alternative sites to determine whether there is any obviously superior alternative site to the site proposed. The Commission's regulations recognize that certain matters need not be resolved at the ESP stage (i.e., an assessment of the benefits, need for power), and thus may be deferred until an applicant decides to apply for a CP or COL. Further, the NRC staff realizes that certain information pertaining to the environmental impacts of construction and operation of new nuclear power facilities may not be available when the NRC staff reviews an ESP application.

In its analysis of some issues, the staff relied on reasonable assumptions made by SERI or the staff. These assumptions, and their bases, are identified in each section, and are documented in Appendix J to this EIS. The NRC staff will verify the continued applicability of these assumptions at the CP or COL stage to determine whether there is new and significant information from that discussed herein.

In its application and in responses to requests for additional information (RAIs), SERI did not or was unable to provide information and analysis for certain issues sufficient to allow the NRC staff to complete its independent analysis. The staff was unable to determine a unique significance level for such issues in this EIS, and therefore, these issues are not resolved for the Grand Gulf ESP site. For such issues, SERI did not offer, nor did the staff identify bases for assumptions that would allow resolution.

As provided by 10 CFR 52.39(a)(2), the Commission shall treat those matters that are resolved through this EIS as resolved in any later proceeding on an application for a CP or COL referencing the requested Grand Gulf ESP. However, as discussed in the NRC staff's July 6, 2005, letter to Mr. A. Heymer of the Nuclear Energy Institute, a CP or COL applicant must identify whether there is new and significant information on these resolved issues. This complements the obligation of a COL applicant referencing an ESP to provide information to resolve any significant environmental issue not considered in the previous proceeding on the ESP. Inasmuch as an ESP and a COL are major federal actions, both actions require the preparation of an EIS pursuant to 10 CFR 51.20. As provided in 10 CFR 52.79 and under NEPA, the CP or COL environmental review will be informed by the EIS prepared at the ESP stage, and the NRC staff intends to use tiering and incorporation-by-reference whenever it is appropriate to do so. The CP or COL applicant must address any other issue not considered and not resolved in the EIS for the ESP. Moreover, pursuant to 10 CFR 51.70(b), the NRC is required to independently evaluate and be responsible for the reliability of all information used in an EIS prepared for a CP or COL application, and the staff may (1) inquire into the continued

validity of information disclosed in an EIS for an ESP that is referenced in a COL application, and (2) look for any new information that may affect the assumptions, analyses, or conclusions reached in the ESP EIS.

In addition, measures and controls to limit any adverse impact will be identified and evaluated for feasibility and adequacy in limiting adverse impacts at the ESP stage, where possible, and at the CP or COL stage. As a result of the staff's environmental review of the ESP application, the staff may determine that conditions or limitations on the ESP may be necessary in specific areas, as set forth in 10 CFR 52.24. Therefore, the staff has identified in this EIS when and how assumptions and bounding values limit its conclusions on the environmental impacts to a particular resource.

Following requirements set forth in 10 CFR Part 51 and the guidance in RS-002, the NRC environmental staff (and its technical experts from the Pacific Northwest National Laboratory retained to assist the staff) visited the Grand Gulf ESP site and alternative sites in July 2003 and during January, April, June, and July 2004 to gather information and to become familiar with the sites and their environs. During these site visits, the staff and its contractor personnel met with the applicant's staff, public officials, Federal and State regulators, and the public.

On December 31, 2003, NRC published a Notice of Intent in the *Federal Register* to prepare an EIS and conduct a scoping process (68 FR 75656). The public scoping period for this EIS closed on February 12, 2004. A public scoping meeting was held on January 21, 2004, in Port Gibson, Mississippi to obtain public input on the scope of the environmental review. The staff reviewed the comments received during scoping and consulted with Federal, State, Tribal, and local agencies. A list of the organizations contacted is provided in Appendix B. Comments received during the scoping period that were within the scope of this EIS are provided in Appendix D.

The results of the NRC staff's analysis were documented in a draft EIS (DEIS) issued for public comment on April 29, 2005. A 75-day comment period began on April 29, 2005, when the U.S. Environmental Protection Agency issued a Notice of Availability (70 FR 22308) of the DEIS to allow members of the public to comment on the results of the NRC staff's review. On June 28, 2005, a public meeting was held in Port Gibson, Mississippi. At the meeting, the staff described the results of the NRC environmental review, answered questions related to the review, and provided members of the public with information to assist them in formulating their comments. Comments on the DEIS and the staff's responses are provided in Appendix E. This final EIS has change bars in the margin to denote where changes have been made since the DEIS was published.

To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC established a standard for quantifying environmental impacts using the Council on Environmental Quality guidance (40 CFR 1508.27). Using this approach, the NRC established

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three significance levels: SMALL, MODERATE, or LARGE. The definitions of these significance levels are as follows:

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

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

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

This EIS presents the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action at the Grand Gulf ESP site, including the environmental impacts associated with construction and operation of one or more new nuclear units at the site, the environmental impacts of granting an ESP at alternative sites, the environmental impacts of alternatives to granting an ESP (including the no-action alternative and alternate energy sources), and mitigation measures available for reducing or avoiding adverse environmental effects. This EIS also contains the NRC staff's recommendation, based on its environmental review, to the Commission regarding the suitability of the Grand Gulf ESP site for construction and operation of one or more reactors with characteristics that fall within the PPE.

1.2 The Proposed Federal Action

The proposed Federal action is issuance, under the provisions of 10 CFR Part 52, of an ESP for the Grand Gulf ESP site for one or more new nuclear power units with characteristics that fall within the SERI PPE (see Appendix I). The proposed action does not include approval to construct or operate the proposed new unit or units, nor does it include authorization to conduct site preparation and preliminary construction activities. While the construction and operation of new units are not currently proposed, this EIS analyzes the environmental impacts that would result from the construction and operation of one or more new nuclear units at the Grand Gulf ESP site or at three alternative sites. The impacts are analyzed to determine whether an alternative site is obviously superior to the proposed site.

The Grand Gulf ESP site is located in Claiborne County in southwestern Mississippi (see Figure 1-1). The site is on the east side of the Mississippi River about 40 km (25 mi) south of Vicksburg, Mississippi, 10 km (6 mi) northwest of Port Gibson, Mississippi, and 60 km (37 mi) north-northeast of Natchez, Mississippi. It is situated within the existing boundaries of the Grand Gulf site, with the new nuclear power unit or units to be sited adjacent to the existing Unit 1. The original GGNS site was designed and evaluated for two nuclear units and two turbine generator sets. Construction of the second unit was halted prior to its completion.

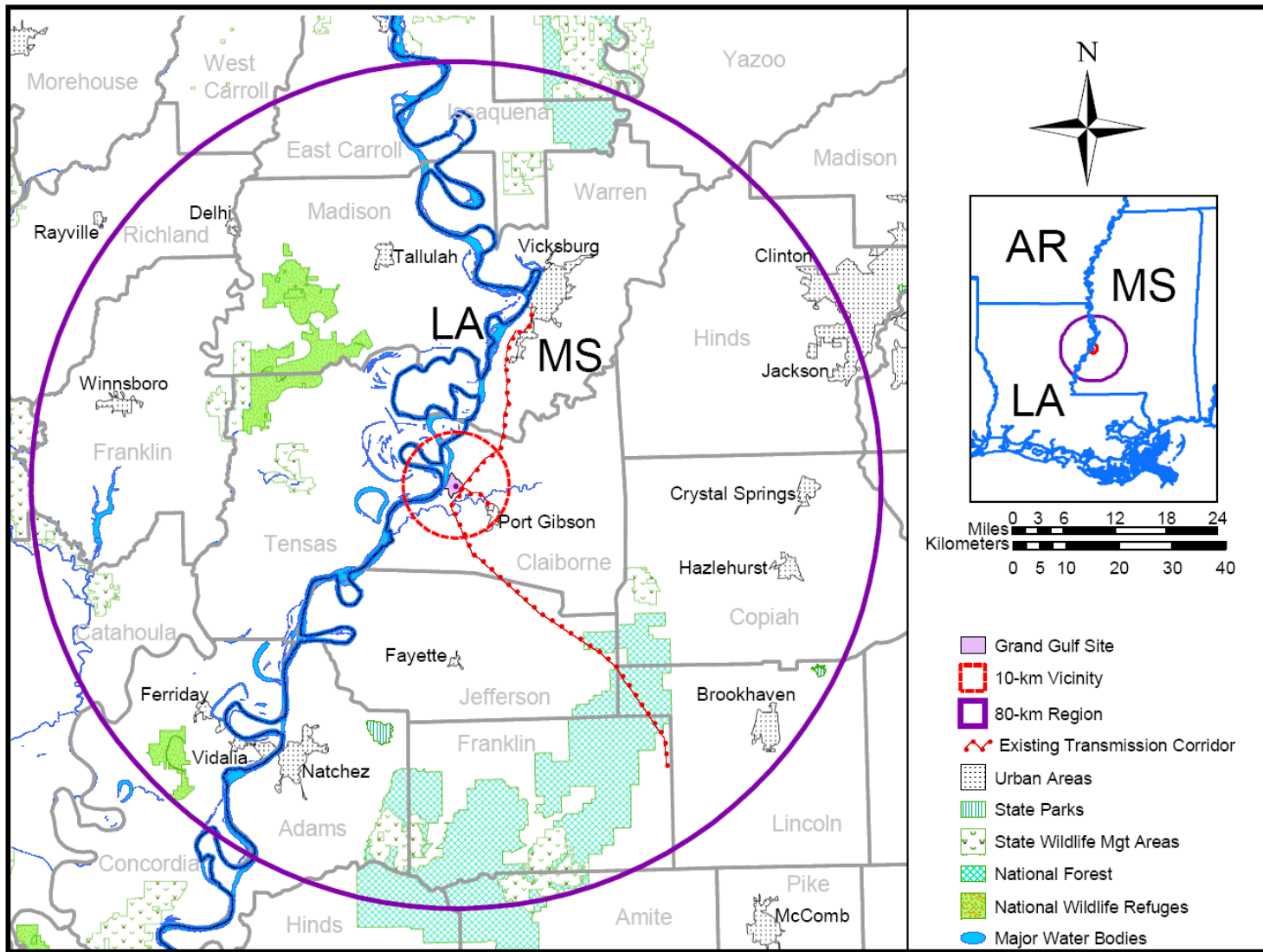


Figure 1-1. Region within 80 Kilometers (50 Miles) of the Proposed Grand Gulf Early Site Permit Site

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However, the majority of the Unit 2 power block buildings were completed, along with the outer cylindrical concrete wall of the reactor containment building. The switchyard was designed and constructed to accommodate two units.

No specific plant design has been chosen for the new unit(s). Instead, a PPE was chosen by SERI to provide bounds for evaluating the impacts from construction and operation of one or more new nuclear power units at the Grand Gulf ESP site. The PPE for the Grand Gulf ESP site (see Appendix I) envisions construction and operation of various numbers of new reactors and/or modules, configured as one or more operating units, up to a total of 8600 MW(t) or 3000 MW(e). Final thermal power would be dependent on the reactor plant type selected for construction at the CP or COL stage. The PPE states that waste heat would be dissipated by either mechanical draft or natural draft cooling towers. Makeup water for the cooling towers and water for other miscellaneous cooling needs at the plant would be withdrawn from the Mississippi River through an intake structure.

1.3 The Purpose and Need for Proposed Action

The purpose and need for the proposed action (issuance of an ESP) is to provide stability in the licensing process by addressing safety and environmental issues before facilities are built, rather than after construction is completed. This process allows for early resolution of many safety and environmental issues that may be identified for the ESP site. In the absence of an ESP, an applicant may apply for a CP and operating license under 10 CFR Part 50, where safety and environmental reviews would continue during plant construction. Alternatively, all safety and environmental issues would have to be addressed at the time of the staff's review of a CP or COL application submitted under 10 CFR Part 52 if no ESP for the site were referenced in the application. Although actual construction and operation of the facility would not take place until a CP or COL is granted, certain lead-time activities, such as ordering and procuring certain components and materials necessary to construct the plant, may begin before the CP or COL is granted. As a result, without the ESP review process, there could be a considerable expenditure of funds, commitment of resources, and passage of time before site safety and environmental issues are finally resolved.

1.4 Alternatives to Proposed Action

Section 102(2)(C)(iii) of NEPA (42 USC 4321, et seq.) states that EISs will include a detailed statement on alternatives to the proposed action. The NRC regulations for implementing Section 102(2) of NEPA provide for inclusion of a discussion in an EIS of the environmental impacts of the proposed action and the alternatives (10 CFR Part 51, Subpart A, Appendix A).

Chapter 8 of this EIS discusses the environmental impacts of four categories of alternatives: (1) the no-action alternative, (2) alternative energy sources, (3) system design alternatives, and (4) alternative sites.

The no-action alternative is discussed in Section 8.1. Section 8.2 discusses the environmental impacts associated with energy alternatives to the proposed action. Section 8.3 discusses alternative plant systems at the ESP site, including alternative heat-dissipation systems and alternative circulating water systems. Section 8.4 includes subsections discussing Entergy's region of interest for identifying alternative nuclear power plant sites and the methodology used by Entergy to select alternative sites. Section 8.5 discusses alternative sites to the proposed Grand Gulf ESP site and the environmental impacts associated with constructing and operating one or more new nuclear generating units at the three alternative sites. The three sites that are considered in detail are sites with existing operating nuclear power plants owned and operated by Entergy and licensed by NRC. The three sites are the River Bend Station in Louisiana, James A. FitzPatrick Nuclear Power Plant in New York, and Pilgrim Nuclear Station in Massachusetts. The environmental impacts at the Grand Gulf ESP site and at the alternative sites are compared in Chapter 9, which also provides a qualitative determination of whether an obviously superior alternative site to the proposed site exists.

1.5 Compliance and Consultations

Prior to construction and operation of a new reactor or reactors, SERI would be required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal, State, and local regulatory requirements. In its environmental report (SERI 2005), SERI provided a list of the authorizations from and consultations with Federal, State, and local authorities that would be associated with construction and operation of one or more new nuclear power units at the Grand Gulf ESP site. Because an ESP is limited to establishing the acceptability of the proposed site for future development, the authorizations that SERI will need from Federal, State, and local authorities for construction and operation are not yet necessary; therefore, they have not been obtained. Potential authorizations and consultations relevant to the proposed ESP are included in Appendix G. The information provided is based on guidance in NUREG-1555 (NRC 2000).

The staff reviewed SERI's environmental report (SERI 2005) and contacted the appropriate Federal, State, and local agencies to identify any compliance, permit, or significant environmental issues of concern to the reviewing agencies that may affect the suitability of the proposed Grand Gulf ESP site for construction and operation of one or more nuclear power units that fall within the SERI PPE.

1.6 Report Contents

The subsequent chapters of this EIS are organized as follows:

- Chapter 2 describes the environment of the Grand Gulf ESP site that would be affected by construction and operation of an additional nuclear power facility at the site.
- Chapter 3 provides a description of the proposed nuclear power facility, based on the PPE included in the SERI application.
- Chapters 4 and 5 analyze the environmental consequences of construction (Chapter 4) and operation (Chapter 5) of the proposed nuclear power facility at the Grand Gulf ESP site.
- Chapter 6 analyzes the environmental impacts of the fuel cycle, transportation of radioactive materials, and decommissioning at the Grand Gulf ESP site.
- Chapter 7 discusses the cumulative impacts of the proposed action as defined in 40 CFR 1508.7.
- Chapter 8 examines the impacts associated with implementing alternatives to granting an ESP at the Grand Gulf ESP site, including the no-action alternative, alternative energy sources, station design alternatives, and alternative sites.
- Chapter 9 presents a comparison of the proposed action and the alternatives.
- Chapter 10 summarizes the findings of the preceding chapters and presents the conclusions reached by NRC staff with respect to the approval of the proposed site for an ESP based on the staff's evaluation of environmental impacts.

The appendixes to the EIS provide the following additional information:

- Appendix A - Contributors to the Environmental Impact Statement
- Appendix B - Organizations Contacted
- Appendix C - Chronology of NRC Staff Environmental Review Correspondence Related to System Energy Resources, Inc.'s Application for an Early Site Permit (ESP) at the Grand Gulf ESP Site
- Appendix D - Scoping Meeting Comments and Responses

- Appendix E - Comments on the Draft Environmental Impact Statement and Responses
- Appendix F - Key Correspondence
- Appendix G - Authorizations and Consultations
- Appendix H - Data and Information to Support Specific Analyses
- Appendix I - Plant Parameter Envelope Values
- Appendix J - System Energy Resources, Inc. Commitments and NRC Staff Assumptions Relevant to the Analysis of Impact

Dimensional units in this EIS are presented in metric form with English units in parentheses. Conversions necessarily induce small rounding errors.

Potential impacts to the area surrounding the Grand Gulf ESP site are categorized as impacts to the vicinity (immediate area) and to the region (next immediate area):

Vicinity Definition

When describing the impacts to land use, the vicinity is defined as the area with a radius of 10 km (6 mi) from the center of the proposed power block.

When describing the socioeconomic impacts, the vicinity is defined as the area with a radius of 16 km (10 mi) from the center of the proposed power block.

Region Definition

When describing the impacts to land use and socioeconomics, the region is defined as the area with a radius of 80 km (50 mi) from the center of the proposed power block.

1.7 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits, Standard Design Certifications, and Combined Licenses for Nuclear Power Plants."

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40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

68 FR 75656. December 31, 2003. "System Energy Resources, Inc., Grand Gulf Site; Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, U.S. Nuclear Regulatory Commission.

| 70 FR 22155. April 28, 2005. "System Energy Resources, Inc.; Notice of Availability of the Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site and Associated Public Meeting." *Federal Register*, U.S. Nuclear Regulatory Commission.

| 70 FR 22308. April 29, 2005. "Environmental Impact Statements; Notice of Availability." *Federal Register*, U.S. Environmental Protection Agency.

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U.S. Nuclear Regulatory Commission (NRC). 2004. *Processing Applications for Early Site Permits*. RS-002, Washington, D.C. Available at <http://www.nrc.gov/reading-rm/adams.html>, Accession No. ML040700236.

U.S. Nuclear Regulatory Commission (NRC). 2005. *Safety Evaluation Report of Early Site Permit Application in the matter of System Energy Resources, Inc., a subsidiary of Entergy Corporation, for the Grand Gulf Early Site Permit Site*. Available at <http://www.nrc.gov/reactors/new-licensing/esp/grand-gulf.html>. Accession No. ML052860041.