NUREG-1817

Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site

Final Report

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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Division of License Renewal
Office of Nuclear Reactor Regulation
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Abstract

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by System Energy Resources, Inc. (SERI) for an early site permit (ESP). The proposed action requested in SERI's application is for the NRC to (1) approve a site within the existing Grand Gulf site boundaries as suitable for the construction and operation of a new nuclear power generating facility, and (2) issue an ESP for the proposed site identified as the Grand Gulf ESP site co-located with the existing Grand Gulf Nuclear Station. This EIS includes the NRC staff's analysis that considers and weighs the environmental impacts of constructing and operating one or more new nuclear units at the Grand Gulf ESP site or at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's recommendation to the Commission regarding the proposed action.

As part of the NRC review of the application, the NRC solicited comments from the public on a draft of this EIS. Appendix E of this document sets forth all public comments received on the draft EIS and the NRC staff's responses to these comments, organized by subject matter. The comments on the draft EIS are in the Agencywide Document Access and Management System (ADAMS). ADAMS can be accessed through the NRC's website at www.nrc.gov/reading-rm/adams.html. Where appropriate, changes were made to the draft EIS and are identified by change bars in the margins of this EIS.

The staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the ESP should be issued. The staff's evaluation of the safety and emergency preparedness aspects of the proposed action is documented in a separate safety evaluation report prepared in accordance with Title 10 of the Code of Federal Regulations Part 52.

This recommendation is based on (1) the application, including the environmental report, submitted by SERI; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process and on the draft EIS; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the environmental report and this EIS. In addition, in making its recommendation, the staff concluded that there are no environmentally preferable or obviously superior alternative sites.

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Executive Summary

On October 16, 2003, the U.S. Nuclear Regulatory Commission (NRC) received an application from System Energy Resources, Inc. (SERI) for an early site permit (ESP) for a location identified as the Grand Gulf ESP site, co-located with the Grand Gulf Nuclear Station. The proposed Grand Gulf ESP site is located in Claiborne County, Mississippi, approximately 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. An ESP is a Commission approval of a location for siting one or more nuclear power facilities and is a separate action from the filing of an application for a construction permit or combined construction permit and operating license (combined license) for such a facility. An ESP application may refer to a reactor's or reactors' characteristics or plant parameter envelope, which is a set of postulated design parameters that bound the characteristics of a reactor or reactors that might be built at a selected site. Alternatively, an ESP application may refer to a detailed reactor design. An ESP is not a license to build a nuclear power plant. Rather, the application for an ESP initiates a process undertaken to assess whether a proposed site is suitable should SERI decide to pursue a construction permit or combined license.

Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321 et seq.) directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. Subpart A of Title 10 of the Code of Federal Regulations (CFR) Part 52 contains the NRC regulations related to ESPs. The NRC implemented Section 102 of NEPA in 10 CFR Part 51. As set forth in 10 CFR 52.18, the Commission determined that an EIS will be prepared during the review of an application for an ESP. The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for one or more new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site. Part 52 of Title 10 describes the ESP as a "partial construction permit." An applicant for a construction permit or combined license for a nuclear unit or units to be located at the site for which an ESP was issued can reference the ESP, thus reducing the review of siting issues at that stage of the licensing process. However, a construction permit or combined license to construct and operate a nuclear power plant is a major Federal action that requires its own environmental review in accordance with 10 CFR Part 51.

Three primary issues – site safety, environmental impact, and emergency planning – must be addressed in an ESP application. Likewise, in its review of the application, the NRC assesses SERI's proposal in relation to these issues and determines if the application meets the requirements of the Atomic Energy Act of 1954 and the NRC regulations. This EIS addresses the potential environmental impacts resulting from construction and operation of one or more new nuclear units at the proposed and alternative sites.

In accordance with 10 CFR 52.18, the EIS is focused on the environmental effects of construction and operation at the ESP site and alternative sites of a reactor or reactors that have characteristics that fall within SERI's plant parameter envelope.

Upon acceptance of the SERI ESP application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* a Notice of Intent (68 FR 75656) to prepare an EIS and conduct a scoping process. The staff held a public scoping meeting in Port Gibson, Mississippi on January 21, 2004, and visited the Grand Gulf ESP site on July 29, 2003, January 21, 2004, and April 12 and 13, 2004. Subsequent to the scoping meeting and the site visits and in accordance with NEPA and 10 CFR Part 51, the staff evaluated the potential environmental impacts of constructing and operating one or more new nuclear units at the Grand Gulf ESP site.

During the course of preparing this EIS, the staff reviewed the application, including the environmental report submitted by SERI, consulted with Federal, State, Tribal, and local agencies, and followed the guidance set forth in NRC review standard RS-002, *Processing Applications for Early Site Permits*, to conduct an independent review of the issues. The review standard draws from the previously published NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*, and NUREG-1555, *Environmental Standard Review Plan*. In addition, the staff considered the public comments related to the environmental review received during the scoping process and on the draft EIS (DEIS). These comments are provided in Appendix D and Appendix E of this EIS.

Following the practice the staff used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437) and supplemental operating license renewal EISs, environmental issues are evaluated using the three-level standard of significance – SMALL, MODERATE, or LARGE – developed by NRC using guidelines from the Council on Environmental Quality. The footnote to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the following definitions of the three significance levels:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The results of this evaluation were documented in a DEIS issued for public comment on April 29, 2005. During the comment period, the staff conducted a public meeting in Port Gibson, Mississippi on June 28, 2005 to describe the results of the NRC environmental review, answer questions, and provide members of the public with information to assist them in formulating comments on the DEIS. After closure of the comment period on the DEIS, the staff considered and dispositioned all the comments received.

Included in this EIS are (1) the results of the NRC staff's analyses, which consider and weigh the environmental effects of the proposed action (issuance of the ESP) and of constructing and operating one or more new nuclear units at the ESP site, (2) mitigation measures for reducing or avoiding adverse effects, (3) the environmental impacts of alternatives to the proposed action, and (4) the NRC staff's recommendation regarding the proposed action based on its environmental review.

The NRC staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the ESP should be issued. The NRC staff's evaluation of the safety and emergency preparedness aspects of the proposed action is documented in a separate safety evaluation report prepared in accordance with 10 CFR Part 52.

The NRC staff's recommendation is based on (1) the application, including the environmental report submitted by SERI; (2) consultation with other Federal, State, Tribal, and local agencies; (3) the NRC staff's independent review; (4) the NRC staff's consideration of public comments related to the environmental review that were received during the scoping process and on the DEIS; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the environmental report and this EIS. In addition, in making its recommendation to the Commission, the NRC staff has determined that there are no environmentally preferable or obviously superior alternative sites.

Abbreviations/Acronyms

ABWR	Advanced Boiling Water Reactor
ac	acre
ACE	U.S. Army Corps of Engineers
ACR-700	Advanced CANDU (CANada Deuterium Uranium) Reactor
ADAMS	Agencywide Document Access and Management System
ALARA	as low as is reasonably achievable
AP1000	Advanced Pressurized Water Reactor
AQCR	air quality control region
AQI	Air Quality Index
ATWS	anticipated transient without scram
BEIR	Biological Effects of Ionizing Radiation
Bq	becquerel
Btu	British thermal unit
BWR	boiling water reactor
°C	degree Celsius
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
Ci	curie(s)
cm	centimeter(s)
CO	carbon monoxide
COL	combined license
CORMIX	Cornell Mixing Zone Expert System
CP	construction permit
CZMA	Coast Zone Management Act of 1972
d	day
dBA	decibels, A scale
DBA	design basis accident
DEIS	draft environmental impact statement
DOE	U.S. Department of Energy
EAB	exclusion area boundary
EIA	Energy Information Administration
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EMI	Entergy Mississippi, Inc.
EMF	electromagnetic field

EPA	U.S. Environmental Protection Agency
ESBWR	Economic Simplified Boiling Water Reactor
ESP	early site permit
ESRP	Environmental Standard Review Plan
°F	degree Fahrenheit
FE	Federal endangered
FERC	Federal Energy Regulatory Commission
FFIEC	Federal Financial Institutions Examination Council
FR	*Federal Register*
FT	Federal threatened
ft	feet
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
GEIS	generic environmental impact statement
GGNS	Grand Gulf Nuclear Station
gpd	gallons per day
gpm	gallons per minute
GT-MHR	Gas Turbine Modular Helium Reactor
ha	hectare(s)
HMA	Habitat Management Area
hr	hour(s)
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
in.	inch(es)
INEEL	Idaho National Engineering and Environmental Laboratory
IRIS	International Reactor Innovative and Secure
J	Joule(s)
kg	kilogram(s)
km	kilometer(s)
kWh	kilowatt-hour(s)
L	liter(s)
L/d	liters per day
LMDCT(s)	linear mechanical draft cooling tower(s)
LNHP	Louisiana Natural Heritage Program
LOCA	loss-of-coolant accident
LPZ	low population zone
LWR	light water reactor

m	meter(s)
MDEQ	Mississippi Department of Environmental Quality
MEI	maximally exposed individual
mg	milligram(s)
mGy	milligray(s)
mi	mile(s)
MISER	Massachusetts Institute for Social and Economic Research
MNHP	Mississippi Natural Heritage Program
MP&L	Mississippi Power and Light
mrad	millirad(s)
mrem	millirem(s)
MS	Mississippi State (Highway)
MSL	mean sea level
mSv	millisievert(s)
MT	metric ton(s)
MTU	metric tons uranium
MWd	megawatt day
MW(e)	megawatts electrical
MW(t)	megawatts thermal
NA	not available
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act of 1969
NESC	National Electrical Safety Code
NHPA	National Historical Preservation Act of 1966
NHS	normal heat sink
NIEHS	National Institute of Environmental Health Sciences
NMPNS	Nine Mile Point Nuclear Station
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PBMR	Pebble Bed Modular Reactor
PM	particulate matter
PM_{10}	particulate matter with a diameter of fewer than 10 micrometers
PPE	plant parameter envelope
ppm	parts per million
ppt	parts per thousand
PWR	pressurized water reactor
RCIC	reactor core isolation cooling
REMP	radiological environmental monitoring program
RM	River Mile

ROI	region of interest
RSICC	(Oak Ridge) Radiation Safety Information Computational Center
Ryr	reactor year(s)
SCR	selective catalytic reduction
SE	state endangered
SERI	System Energy Resources, Inc.
SMEPA	South Mississippi Electric Power Association
SOx	sulfur oxides
SR	State Route
ST	state threatened
Sv	sievert(s)
SWS	service water system
SWU	separative work units
T&D	transmission and distribution (system)
TEDE	total effective dose equivalent
TLDs	thermoluminescence dosimeters
UFSAR	Updated Final Safety Analysis Report
UHS	ultimate heat sink
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
yr	year(s)
X/Q	normalized concentration

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 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 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 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.

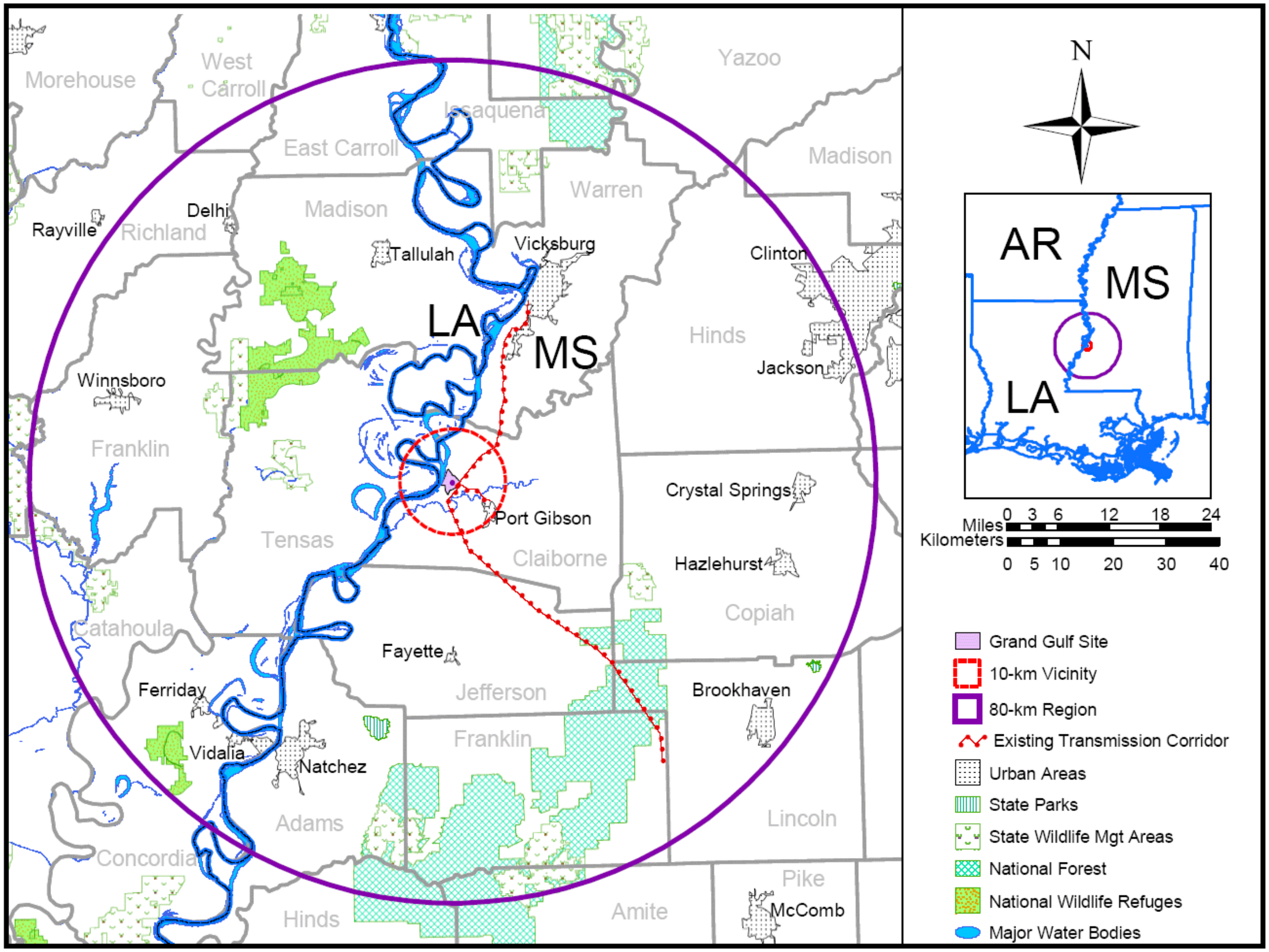

Figure 1-1. Region within 80 Kilometers (50 Miles) of the Proposed Grand Gulf Early Site Permit Site

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.”

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.

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System Energy Resources, Inc. (SERI). 2005. *Grand Gulf Site Early Site Permit Application.* Revision 2, Jackson, Mississippi. Available at http://www.nrc.gov/reading-rm/adams.html, Accession No. ML052780449.

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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.

2.0 Affected Environment

The site proposed by System Energy Resources, Inc. (SERI) for an early site permit (ESP) is located in Claiborne County, Mississippi, within the existing boundaries of the currently operating Grand Gulf Nuclear Station (GGNS) site. The site is on the east bank of the Mississippi River at River Mile 406, approximately 40 km (25 mi) south of Vicksburg, Mississippi and 60 km (37 mi) north-northeast of Natchez, Mississippi. The proposed Grand Gulf ESP facility location is described in Section 2.1, with the land, meteorology and air quality, geology, radiological environment, water, ecology, socioeconomics, historic and cultural resources, and environmental justice conditions of the site presented in Sections 2.2 through 2.10, respectively. Section 2.11 examines related Federal projects, and references are presented in Section 2.12.

To distinguish the areas discussed, “Grand Gulf site” refers to the entire 850-ha (2100-ac) property upon which GGNS Unit 1 and all existing facilities are located as well as the proposed Grand Gulf ESP facility. This environmental impact statement (EIS) refers to the “Grand Gulf site” for the entire property, “Grand Gulf Nuclear Station” for the existing facilities, and “Grand Gulf ESP facility/site” for the proposed facilities and area.

2.1 Site Location

SERI’s proposed ESP site is within the Grand Gulf site. The Grand Gulf site is located in rural Claiborne County and is accessible by both river and road. Public transportation routes are limited within the site vicinity. The major highway in the vicinity of the Grand Gulf site is U.S. Highway 61, which passes by on the east-southeast. U.S. Highway 61 parallels the Mississippi River from New Orleans, Louisiana, to St. Louis, Missouri, and is approximately 7.2 km (4.5 mi) from the Grand Gulf site at the closest point. From Port Gibson, the highway goes north to Vicksburg, Mississippi, and south-southwest to Natchez, Mississippi. A section of the Natchez Trace Parkway passes approximately 10 km (6 mi) southeast of the Grand Gulf site running southwest toward Natchez and to the northeast to Jackson. State Highway 18 runs east from Port Gibson to Jackson. A number of county and rural roads are in the vicinity of the site. Figure 2-1 shows the area within a 10-km (6-mi) radius of the proposed Grand Gulf ESP facility.

Figure 1-1 shows the location of the Grand Gulf ESP site in relation to the counties and larger cities and towns in the region–the area within a radius of 80 km (50 mi) from the center of the proposed power block. The Grand Gulf ESP site consists primarily of woodlands and former farms as well as two lakes, Hamilton Lake and Gin Lake. These lakes were once in the channel of the Mississippi River and have an average depth of 2 to 3 m (8 to 10 ft). The land in the vicinity of the Grand Gulf site is mostly rural.

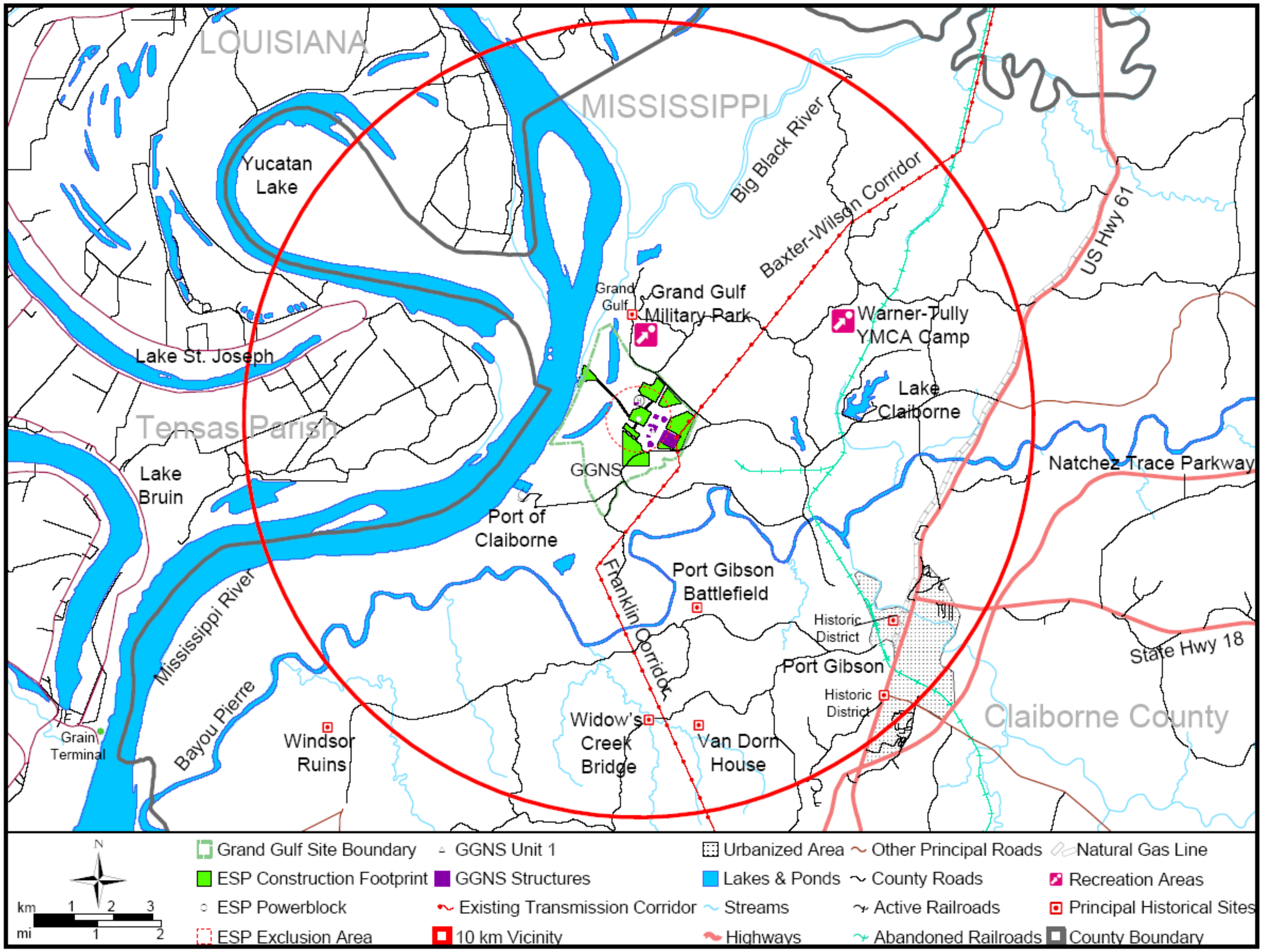

Figure 2-1. Map Showing Location and Vicinity within 10 Kilometers (6 Miles) of the Proposed Grand Gulf Early Site Permit Site

The western half of the site is the Mississippi Alluvial Valley, consisting of materials deposited by the Mississippi River and extending eastward from the river about 1.3 km (0.8 mi). The area is generally at elevations of 17 to 23 m (55 to 75 ft) above mean sea level (MSL). The eastern half of the site is rough and irregular with steep slopes and deeply cut stream valleys and drainage courses. Ground elevations in this portion of the Grand Gulf ESP site range from 24.4 m (80 ft) above MSL to more than 61 m (200 ft) above MSL inland. Elevations of about 122 m (400 ft) above MSL occur on the hilltops east and northeast of the site. Grade elevation for the existing GGNS facility structures is 40.4 m (132.5 ft) above MSL (SERI 2005).

2.2 Land

The Grand Gulf ESP site is 162 ha (400 ac) located on a portion of the Grand Gulf site within Claiborne County, Mississippi, approximately 10 km (6 mi) northwest of Port Gibson, the county seat. Claiborne County lies in southwestern Mississippi and is bordered on the west by the Mississippi River and Tensas Parish, Louisiana, on the north by Warren County, on the east by Hinds and Copiah counties, and on the south by Jefferson County. This section describes the land uses of the site, vicinity, and region affected by the Grand Gulf ESP facility.

2.2.1 Site and Vicinity

The Grand Gulf ESP facility would be located on the existing Grand Gulf site, slightly to the west and north of the GGNS power block. The Grand Gulf site encompasses approximately 850 ha (2100 ac) and lies within the property boundary shown in Figure 2-1. SERI, South Mississippi Electric Power Association, and Entergy Mississippi, Inc. are currently the primary owners of the Grand Gulf site. Entergy Operations, Inc. holds the operating license for the GGNS and maintains control of entrances and exits from the Grand Gulf site property. According to the SERI environmental report, approximately 162 ha (400 ac) of the 850 ha (2100 ac) would be directly affected by construction on the Grand Gulf ESP site (SERI 2005). Most of the area at the site that may be used for new construction was previously disturbed when GGNS was constructed in the early 1970s.

The vicinity of the Grand Gulf ESP site is defined by a circle drawn with a 10-km (6-mi) radius from the center of the proposed power block location (Figure 2-1). The vicinity includes a portion of Claiborne County in Mississippi and Tensas Parish in Louisiana. Table 2-1 provides the land cover classifications within the 10-km (6-mi) vicinity, in the 80-km (50-mi) region, and along the affected transmission line rights-of-way. The land use in the vicinity of the site includes primarily agricultural and undeveloped lands. The nearest incorporated community is the town of Port Gibson about 10 km (6 mi) southeast of the site. The small community of Grand Gulf lies about 2.6 km (1.6 mi) north of the Grand Gulf ESP site.

Table 2-1. Land Use in the Area of the Grand Gulf Early Site Permit Site

Land-Use Class	80-km (50-mi) Region Hectares (Acres)	80-km (50-mi) Region Percent	10-km (6-mi) Vicinity Hectares (Acres)	10-km (6-mi) Vicinity Percent	Transmission Line Rights-of-Way Hectares (Acres)	Transmission Line Rights-of-Way Percent
Agricultural	557,511 (1,377,640)	27.7	3,552 (8,777)	11.3	100 (246)	14.7
Developed Nonresidential	4,100 (10,132)	0.2	140 (346)	0.4	1 (3)	0.2
Residential	30,313 (74,904)	1.5	504 (1,245)	1.6	11 (28)	1.7
Undeveloped	1,230,416 (3,040,423)	61.2	20,114 (49,703)	64.0	524 (1,296)	77.7
Water or Wetlands	189,089 (467,249)	9.4	7,118 (17,589)	22.6	39 (96)	5.8
Total Area	**2,011,428 (4,970,348)**		**31,428 (77,660)**		**675 (1,669)**	

Notes: U.S. Geological Survey land-cover classes have been aggregated for presentation purposes. Rounding may affect totals.
Source: Vogelmann et al. 2001

A number of recreational areas are in the vicinity of the Grand Gulf ESP site. The Grand Gulf Military Monument (162 ha (400 ac)) abuts the northern edge of the Grand Gulf site and has its main facilities about 3 km (2 mi) north of the Grand Gulf ESP site. The Grand Gulf Military Monument provides a year-round, 25-site campground and hosts many living history events and other activities for area visitors. The Warner-Tully YMCA Camp (44 ha (108 ac)) is a youth summer camp located approximately 5 km (3 mi) northeast of the site. Lake Claiborne is a private residential development with recreational facilities located on the lake about 5 km (3 mi) east of the Grand Gulf ESP site. Two oxbow lakes located on the Grand Gulf site (Hamilton and Gin lakes) provide limited small boating and fishing opportunities, and public access is permitted. Yucatan Lake in Louisiana also falls within the 10-km (6-mi) vicinity and offers boating and fishing opportunities.

About 18 km (11 mi) of the Mississippi River courses through the 10-km (6-mi) vicinity. The river provides a critical inland shipping route from the Gulf Coast to the interior of the South and Midwest. There is direct access to the Grand Gulf ESP site from the Mississippi River along the entire western edge of the Grand Gulf site. The Port of Claiborne has constructed a small shipping port on the river at River Mile 404.8 in Claiborne County. The mean depth of channel and berth at Port Claiborne is 4.3 m (14 ft). Services provided at this port include mooring assistance, stevedore, dryage, and deep-water berths. Port cargo includes forest products, pulpwood, feed grains, and agricultural products (see environmental report in SERI 2005).

SERI has acquired and will maintain surface ownership of all the land within the Grand Gulf site property boundary with the following exceptions (see Site Safety Analysis Report in SERI 2005, 2004e):

- South Mississippi Electric Power Association (SMEPA) has a 10-percent undivided interest in the GGNS Unit 1 power block area, a 38-ha (94-ac) tract containing the cooling towers, containment buildings, and other major structures. SMEPA also has a 10-percent undivided ownership interest in two very long and narrow strips of land (3 and 2 ha (7.5 and 5 ac)) on which the GGNS Unit 1 water supply and discharge piping are located.

- Entergy Mississippi, Inc. owns the 21-ha (52-ac) GGNS facility switchyard area on the site. However, under a 1999 agreement with Mississippi Power and Light (now Entergy Mississippi, Inc.), SERI has authority to exercise complete control and determine all activities on Entergy Mississippi, Inc. property and easements on the site, including exclusion of Entergy Mississippi, Inc. personnel and third parties. SERI has transferred such rights to Entergy Operations, Inc. Entergy Operations, Inc. has unrestricted access to the switchyard area.

- A 1-ha (2-ac) residential property, which is totally surrounded by the GGNS site property boundary in the southwest sector of the site, is privately owned.

SERI, SMEPA, and Entergy Operations, Inc. own or effectively control the mineral rights in the proposed power block and associated exclusion area.[a] Currently, mining, exploration, drilling, and other mineral-extraction activities are not being conducted at the Grand Gulf ESP site. Past unsuccessful exploration activities on or near the Grand Gulf ESP site and the geological character of the subsurface structure in the vicinity indicate that commercial mineral production appears unlikely in the foreseeable future. A geological appraisal dated January 1987 (see site safety analysis report in SERI 2005, 2004g) confirmed this conclusion.

Under Mississippi law, prospective mineral developers have no legal right to use physical force or to create a public disturbance to gain access to a property to explore for or to extract minerals. They would be prohibited from drilling any oil or gas well until a permit is issued by the Mississippi State Oil and Gas Board following a notice and public hearing. Since SERI and SMEPA own, and Entergy Operations, Inc. controls substantially all of the minerals on the Grand Gulf site, SERI and Entergy Operations, Inc. would participate in any hearings and would have the opportunity to object to the drilling and/or the location of any well. Therefore, although

(a) The term “exclusion area” is defined in 10 CFR 50.2

SERI and its affiliates do not legally own all of the subsurface rights on the Grand Gulf ESP site and the associated exclusion area, they effectively control the ability to exercise these rights and to preclude the exercising of these rights by others.

The Grand Gulf ESP site is accessible by both river and road. The major highways in the area lie mainly to the east, north, and south of the site, and a number of county roads serve the area (Figures 1-1 and 2-1). U.S. Highway 61 and State Highway 18 connect Port Gibson with Natchez, Vicksburg, and Jackson, Mississippi. There are no direct routes from the site into Louisiana, immediately west of the Mississippi River. U.S. Highway 61 parallels the east bank of the Mississippi River from New Orleans, Louisiana, to St. Louis, Missouri, and is approximately 7.2 km (4.5 mi) from the site at the closest point. From the town of Port Gibson, the highway runs north to Vicksburg and southwest to Natchez. A section of the Natchez Trace Parkway passes approximately 10 km (6 mi) southeast of the Grand Gulf ESP site running southwest toward Natchez, Mississippi, and northeast to Clinton, Mississippi. State Highway 18 runs east from Port Gibson to Jackson. A number of county and rural roads are in the 10-km (6-mi) site vicinity.

No active railroads or navigable waterways traverse the Grand Gulf ESP site. However, a currently abandoned spur of the Illinois Central Gulf railroad once served the area during construction of GGNS Unit 1. The remains of this spur extend 29.2 km (18.2 mi) to the north of the Grand Gulf ESP site where active service begins. One county-maintained road runs through the Grand Gulf ESP site (see Figure 2-1). Bald Hill Road cuts through the south-southeast, south, south-southwest, and southwest sectors of the Grand Gulf site. Another road (unpaved) traverses the GGNS site property in the north, north-northwest, northwest, west-northwest, and west sectors, providing access to the two lakes on the property. Two Entergy-Mississippi transmission lines traverse the eastern edge of the Grand Gulf site. No other industrial, commercial, institutional, or residential structures are on the Grand Gulf site other than a private hunting lodge on the extreme southwest corner. Entergy allows public access to parts of the Grand Gulf site property for recreational purposes (see environmental report in SERI 2005).

The nearest gas pipeline is 6 km (3.7 mi) east of the Grand Gulf site boundary (Figure 2-1). SERI and SMEPA own all the surface rights at the Grand Gulf ESP site except the switchyard, which is owned by Entergy Mississippi, Inc. A number of easements over the Grand Gulf ESP site are in effect (see environmental report in SERI 2005).

According to the environmental report, a review of the Claiborne County Soil Survey issued in 1963 and inquiry with the Claiborne County Natural Resources Conservation Service indicate the presence of soil types that may be considered “prime farmland” at the Grand Gulf site (SERI 2005). However, some exclusions apply. If land is frequently flooded during the growing season or is already in or committed to urban development or water storage, it is not considered "prime farmland" (see environmental report in SERI 2005). No coastal zones or wild and scenic rivers were identified in or around the area that may be used for construction. Because of dense vegetation in the vicinity, the ESP site is not easily seen from nearby areas. The cooling tower and plume are visible from across the Mississippi River in Louisiana.

2.2.2 Transmission Line Rights-of-Way and Offsite Areas

SERI chose not to include a site redress plan in its ESP application and, therefore, would not be permitted to undertake site preparation activities, including work on transmission line rights-of-way, prior to obtaining a construction permit (CP) or combined license (COL). Consequently, because of regulatory constraints at the ESP stage, it is not possible to determine how or which specific transmission lines or rights-of-way may be affected by the addition of the Grand Gulf ESP facility. Once an ESP holder has chosen a specific facility design and has applied to the Federal Energy Regulatory Commission (FERC) for large-generator interconnection (most likely at the COL stage), a FERC transmission analysis would be required (18 CFR Part 35). This process would determine the optimal routing of any new transmission service by requiring studies of feasibility, impact, and facilities associated with the transmission request. See Section 3.3 for additional discussion. As a result, for analysis purposes, the staff assumed that the existing transmission lines leaving the GGNS switchyard would most likely be upgraded to handle the power generated by the proposed facility. The existing GGNS switchyard was built with provision for equipment installation and operation of a second unit. This portion of the switchyard would be used, with modifications as required, for a new facility's switching equipment and connection to existing transmission line(s).

Entergy Mississippi, Inc. owns the two FERC-regulated 500-kV transmission line rights-of-way that originate from the GGNS switchyard (Figure 2-1). The Baxter-Wilson transmission line right-of-way extends north 40.3 km (25.2 mi) from the switchyard to the Baxter-Wilson substation adjacent to the Baxter-Wilson combined-cycle power plant just south of Vicksburg, Mississippi. The Franklin transmission line right-of-way extends southeast 69.8 km (43.6 mi), traversing the Homochitto National Forest, to the Franklin substation near McCall Creek in northeastern Franklin County, Mississippi.

Land use within the transmission line right-of-way consists of agricultural and undeveloped lands. Table 2-1 provides a summary of land cover in the existing transmission line rights-of-way. The staff assumed that affected transmission line rights-of-way would have 61-m (200-ft) vegetation management buffers. The area covered by these buffers represents rights-of-way totaling 677 ha (1669 ac).

2.2.3 Region

The affected region for the purpose of analyzing environmental impacts is the area within 80 km (50 mi) from the center of the proposed power block location (Figure 1-1). That region encompasses significant portions of the following counties in Mississippi and parishes in Louisiana:

- Mississippi - Adams, Amite, Claiborne, Copiah, Franklin, Hinds, Issaquena, Jefferson, Lincoln, Rankin, Sharkey, Warren, and Yazoo

- Louisiana - Catahoula, Concordia, East Carroll, Franklin, Madison, Richland, Tensas, and West Carroll

Interstate 20 passes approximately 32 km (20 mi) north of the Grand Gulf ESP site connecting Vicksburg and Jackson, Mississippi, with towns to the east and west. Interstate 55 passes approximately 58 km (36 mi) east of the Grand Gulf ESP site, connecting Jackson, Mississippi, and New Orleans, Louisiana. U.S. Highway 65 runs north and south in Louisiana and lies approximately 18 km (11 mi) to the west of the Grand Gulf ESP site. U.S. Highway 84 runs east and west, connecting U.S. Highway 65 and Interstate 55, and passes within about 50 km (31 mi) to the south of the site. Figure 2-1 shows the locations of Federal highways and railroads in the site vicinity. The Mississippi River, which passes 1.6 km (1 mi) west of the Grand Gulf ESP site, provides another route for transportation. The nearest river port facility is Port Claiborne at River Mile 404.8. A larger river port facility, which is also a U.S. Customs port of entry, lies north of the site near River Mile 437 in Vicksburg.

The region consists mainly of forest and agricultural lands. Land cover information for Claiborne County and the adjoining counties is presented in Table 2-1. No known local or regional land use plans or other regional development plans affect the Grand Gulf ESP site. About 112 km (70 mi) of the Natchez Trace Parkway, designated as National Scenic Byway and All American Road, traverses the region.

Table 2-2 identifies agricultural land use by major crop in the affected region. Because of the topography of the region, agriculture thrives as an industry on the Louisiana side of the Mississippi River. The Louisiana side is typically a flat alluvial plain, while the Mississippi side is typically upland and rolling, forested hill country. On the Mississippi side, farms are generally smaller than on the Louisiana side (USDA 2004a, 2004b).

Table 2-3 provides information on the region’s livestock production. According to the environmental report, information from the Claiborne County Agricultural Extension office

Table 2-2. 2002 Major Agricultural Crops and Land in Production within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site, hectares (acres)

		Harvested Area of Major Crops							Major Crop Land Harvested	Total Land in Crop Production
County/Parish	**Land Area**	**Corn**	**Cotton**	**Rice**	**Sorghum**	**Soybeans**	**Wheat**	**Hay**		
Catahoula, LA	182,245	7080	13,568	3,064	11,192	13,624	1339	2174	52,041	71,947
	(450,335)	(17,495)	(33,526)	(7,571)[a]	(27,657)	(33,666)	(3309)	(5373)	(128,597)	(177,785)
Concordia, LA	180,240	15,543	9,508	4,955	3,386	20,775	2,164	562	56,894	70,842
	(445,382)	(38,407)	(23,494)	(12,245)	(8,368)	(51,337)	(5,347)	(1,389)	(140,587)	(175,054)
East Carroll, LA	109,153	21,109	12,245	6,880	1,070	28,976	2,294	352	72,926	77,120
	(269,722)	(52,162)	(30,259)	(17,000)	(2,644)	(71,600)	(5,669)	(870)	(180,204)	(190,566)
Franklin, LA	161,516	16,308	22,054	263	923	8,466	11,826	3361	63,203	79,729
	(399,112)	(40,299)	(54,497)	(651)[a]	(2,282)	(20,921)	(29,223)	(8,304)	(156,177)	(197,014)
Madison, LA	161,638	29,204	20,237	1,940	2,315	15,273	2,295	453	71,718	85,332
	(399,415)	(72,164)	(50,007)	(4,795)	(5,721)	(37,741)	(5,671)	(1,120)	(177,219)	(210,858)
Richland, LA	144,640	12,150	13,801	3,313	1,195	7,997	4,890	3,085	46,431	66,326
	(357,411)	(30,023)	(34,103)	(8,187)	(2,952)	(19,762)	(12,084)	(7,622)	(114,733)	(163,894)
Tensas, LA	156,043	21,921	28,917	268	3,153	8,065	3,357	228	65,910	71,085
	(385,589)	(54,168)	(71,456)	(663)	(7,792)	(19,928)	(8,296)	(563)	(162,866)	(175,653)
West Carroll, LA	93,084	6,024	6,450	3,337	2,159	6,046	6,033	3,576	33,625	52,279
	(230,015)	(14,885)	(15,937)	(8,245)	(5,336)	(14,941)	(14,909)	(8,837)	(83,090)	(129,184)
Adams, MS	119,208	1,797				2,558		1,422	5,778	16,376
	(294,567)	(4,440)	D	0	0	(6322)	D	(3,515)	(14,277)	(40,466)
Amite, MS	188,966	142						5,319	5,461	16,633
	(466,944)	(350)	0	0	0	0	0	(13,144)	(13,494)	(41,101)
Claiborne, MS	126,073	1,687	1,396			947	484	2,038	6,552	13,092
	(311,531)	(4,169)	(3,450)	0	D	(2,339)	(1,196)	(5,037)	(16,191)	(32,351)
Copiah, MS	201,140	188						4,044	4,232	18,075
	(497,025)	(464)	D	0	0	0	D	(9,994)	(10,458)	(44,664)

Table 2-2. (contd)

County/Parish	Land Area	Harvested Area of Major Crops: Corn	Cotton	Rice	Sorghum	Soybeans	Wheat	Hay	Major Crop Land Harvested	Total Land in Crop Production
Franklin, MS	146,230	490						1,399	1,889	5,536
	(361,341)	(1,212)	0	0	0	0	0	(3,457)	(4,669)	(13,679)
Hinds, MS	225,119	4,459	4,911			870	27	6,282	16,549	44,001
	(556,278)	(11,019)	(12,135)	0	0	(2,150)	(067)	(15,522)	(40,893)	(108,728)
Issaquena, MS	106,983	9,967	7,015	1,253		12,014	2,491	301	33,041	35,868
	(264,360)	(24,629)	(17,335)	(3,097)	0	(29,687)	(6,155)	(744)	(81,647)	(88,632)
Jefferson, MS	134,521	238	1,819			1,352		1,594	5,003	12,583
	(332,408)	(589)	(4,494)	0	0	(3,341)	0	(3,938)	(12,362)	(31,092)
Lincoln, MS	151,697	206						4,306	4,512	13,303
	(374,851)	(509)	0	0	0	0	D	(10,641)	(11,150)	(32,873)
Rankin, MS	200,599	1,091	2,592			458		4,186	8,327	17,157
	(495,690)	(2,695)	(6,405)	0	D	(1,132)	D	(10,344)	(20,576)	(42,395)
Sharkey, MS	110,777	13,708	18,388	1,363	382	22,166	739	32	56,779	59,986
	(273,735)	(33,874)	(45,437)	(3,369)	(945)	(54,774)	(1,825)	(80)	(140,304)	(148,229)
Warren, MS	151,932	4,174	3,100			7,043	445	982	15,744	21,638
	(375,431)	(10,315)	(7,659)	0	D	(17,404)	(1,099)	(2,427)	(38,904)	(53,468)
Yazoo, MS	238,146	11,807	47,177		974	5,823	2,970	3,364	72,115	87,608
	(588,468)	(29,177)	(116,577)	D	(2,407)	(14,388)	(7,339)	(8,313)	(178,201)	(216,483)
Region Total[b]	3,289,950	179,294	213,178	26,638	26,751	162,454	41,354	49,062	698,730	936,515
	(8,129,610)	(443,045)	(526,771)	(65,823)	(66,104)	(401,433)	(102,189)	(121,234)	(1,726,599)	(2,314,169)

(a) Values from LSU 2003
(b) Totals affected by rounding
D = values not disclosed by U.S. Department of Agriculture
Sources: USDA 2004a, 2004b

Table 2-3. 2002 Livestock Production and Farm Value within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site

	Livestock Inventory				Farm Inventory		
County/Parish	Beef Cows (Head)	Milk Cows (Head)	Hogs and Pigs (Head)	Chickens Sold (Number)	Farms	Average Value per Farm ($)	Average Value Per Acre ($)
Catahoula, LA	4,902		346	30	432	577,352	1,164
Concordia, LA	2,042		(a)		331	690,690	1,127
East Carroll, LA	744		1,553		238	1,101,056	1,194
Franklin, LA	11,200		76		856	334,280	1,191
Madison, LA	1,888		15		275	928,926	1,105
Richland, LA	(a)	(a)	102	(a)	538	494,785	1,045
Tensas, LA	497		30		230	1,047,322	1,055
West Carroll, LA	7,384		84		703	384,114	1,781
Adams, MS	3,844		159		269	336,308	1,004
Amite, MS	9,918	2,896	16	12,930,000	639	348,222	1,572
Claiborne, MS	6,654		(a)	1,000	297	380,948	1,203
Copiah, MS	10,679	870	1,270	9,900,000	690	350,023	1,646
Franklin, MS	(a)	(a)	5	(a)	210	392,149	1,644
Hinds, MS	18,167	1,690	497	20	1,246	343,373	1,348
Issaquena, MS	(a)		100		91	1,529,891	1,169
Jefferson, MS	6,199	9	86	3,900,000	315	419,870	1,467
Lincoln, MS	11,647	2,160	(a)	9,900,000	641	446,949	2,255
Rankin, MS	(a)	(a)	(a)	30,040,000	804	351,427	1,485
Sharkey, MS					100	1,727,477	1,064
Warren, MS	(a)	(a)	(a)		282	471,906	1,095
Yazoo, MS	(a)	(a)	655		564	729,113	1,102
Total Region	95,765	7,625	4,994	66,680,000	9,751	491,662	1,273

(a) Not disclosed by the U.S. Department of Agriculture (USDA), not included in totals.
Sources: USDA 2004a, 2004b

indicated that there are approximately 300 to 400 head of cattle, and no commercial dairy milk cows reported within a 10-km (6-mi) radius of the Grand Gulf ESP site, and most of the cattle are located southwest of the site (SERI 2005).

2.3 Meteorology and Air Quality

Climatological information presented in this section was obtained from the Jackson, Mississippi, first-order National Weather Service station (NCC 1980; NCDC 2004a), which is about 80 km (50 mi) northeast of the proposed Grand Gulf ESP site. This station provides a good indication of the general climate at the Grand Gulf ESP site because of its proximity and long period of record. Recent climatological data for Jackson are available from the National Climatic Data Center in Asheville, North Carolina (NCDC 2004a). This section also contains information from Revision 2 of the environmental report of the SERI application, which provides site-specific data for the Grand Gulf ESP site and data for Vicksburg, Mississippi. Vicksburg is on the Mississippi River about 40 km (25 mi) north of the proposed Grand Gulf ESP site (SERI 2005).

2.3.1 Climate

The Grand Gulf ESP site is within the Grand Gulf site on the east bank of the Mississippi River in southwestern Mississippi about 240 km (150 mi) from the coast of the Gulf of Mexico. The dominant air mass in the region during most of the year is a maritime tropical air mass originating in the Gulf of Mexico. As a result, the climate of the region is humid most of the year. The winters are relatively short and mild with occasional brief cold periods associated with outbreaks of continental polar air. These cold periods rarely last more than three or four days. Summers are long and warm; however, temperatures above 38°C (100°F) are infrequent and long periods of very hot weather are rare. During these summer months, the weather at the site is dominated by the western edge of the Bermuda High.

Mississippi is south of the general track of winter cyclones. This location, in combination with the dominant influence of the Bermuda High in the summer, results in a limited wind resource in the area. Wind energy resource maps prepared for the U.S. Department of Energy (DOE) indicate that Mississippi wind resources fall into Wind Power Class 1, the lowest of seven classes used to rate the resource (DOE 2004c). DOE does not list commercial wind power projects in Mississippi (DOE 2004a).

On average, about 60 percent of the sky at Jackson, Mississippi, is covered by clouds. However, cloudiness varies seasonally and diurnally. Daytime cloudiness at Jackson covers more than 50 percent of the sky during the winter, with maximum sky cover of about 80 percent in December and January. The rest of the year, the average daytime sky cover is 50 percent or less, with minimum sky cover of about 30 percent during September (NCDC 2004a). The DOE estimates the annual average solar resource in the vicinity of the Grand Gulf ESP site to be 4.5 to 5.0 kWh/m^2 per day for flat-panel collectors, and 4.0 to 4.5 kWh/m^2 per day for concentrating collectors (DOE 2004b). The DOE lists two photovoltaic energy projects with a total installed capacity of 44.2 kW in Mississippi (DOE 2004a).

2.3.1.1 Wind

Recent wind data from the GGNS meteorological system presented in the SERI environmental report indicate that the winds at the Grand Gulf ESP site are relatively light (SERI 2005). The average wind speed for the Grand Gulf site during the period from 2001 through 2003 is 1.9 m/s (4.2 mph). This speed is significantly lower than average wind speeds at Vicksburg (SERI 2005) and Jackson (NCDC 2004a), Mississippi. More than 99 percent of the time, the wind speed at the Grand Gulf ESP site is less than 5.8 m/s (13 mph) (SERI 2005). The most prevalent wind direction is from the northeast. Winds from the northeast and southeast quadrants are far more frequent than winds from the southwest and northwest quadrants. The highest wind speeds tend to have a southerly component.

Wind direction persistence is an important consideration in evaluation of the consequences of accidents. Tables 2.7-88 through 2.7-95 of the SERI environmental report (SERI 2005) describe wind direction persistence at GGNS, Vicksburg, and Jackson, Mississippi. Considering the period of record at each site (3 years at GGNS, 5 years at Vicksburg, and 10 years at Jackson), it appears that the GGNS has a somewhat greater persistence than the other two sites. The maximum persistence of wind direction within the 22.5° sectors at GGNS was 32 hours for winds from the northeast. The maximum persistence in 9 of the 16 sectors exceeded 12 hours. The maximum persistence for wind direction within three adjacent sectors at GGNS was 102 hours for winds from the north, north-northeast, and northeast. Persistence exceeded 24 hours for all sets of three winds direction sectors except those sets centered on east and west-southwest. For five adjacent wind direction sectors, the maximum persistence was 122 hours for the five sectors centered on north-northeast. The maximum wind persistence in all sets of sectors exceeded 36 hours.

2.3.1.2 Atmospheric Stability

Atmospheric stability is a measure of the tendency of the atmosphere to dilute material. It can be estimated from the magnitude of change in the ambient temperature with height. Seven atmospheric stability classes based on the temperature difference between two levels are defined in Safety Guide 23 (also referred to as Regulatory Guide 1.23) (AEC 1972). SERI's meteorological monitoring system, which is described in Section 2.3.3, is designed to measure temperature difference for use in estimating atmospheric stability.

When the temperature decreases rapidly with height, the atmospheric stability is described as extremely unstable, and when it increases rapidly with height, the atmospheric stability is described as extremely stable. Extremely unstable atmospheric conditions generally occur on summer afternoons when the wind speed is light. These conditions are associated with good dilution of material. Extremely stable atmospheric conditions generally occur on clear nights, and are associated with very limited dilution. When it is cloudy and windy, atmospheric stability is generally neutral.

Data for 2002 and 2003 from the GGNS meteorological system indicate that on average the atmospheric stability is neutral about 35 percent of the time. About 47 percent of the time, the atmospheric stability is slightly to extremely stable, and the remaining 18 percent of the time, the atmospheric stability is slightly to extremely unstable.

2.3.1.3 Temperature

The long-term (95-yr) annual average temperature in Jackson is 18.4°C (65.2°F), with monthly average temperatures ranging from 8.4°C (47.2°F) in January to 27.7°C (81.9°F) in July. During the year, the normal (based on data for 1971 through 2000) number of days with minimum temperatures of 0°C (32°F) and below is 46, while the normal number of days with maximum temperatures of 0°C (32°F) and below is less than 2. The lowest temperature at the current and comparable measurement locations, based on a 63-yr period of record, is -17°C (2°F). Temperatures below -18°C (0°F) have been observed in the area. In contrast, the normal number of days with maximum temperatures of 32°C (90°F) and above is 84, and the highest temperature on record is 42°C (107°F).

The monthly mean temperatures for 2000 and 2001 are consistent with monthly mean temperatures for a 5-year period at Vicksburg and a 40-year period at Jackson (SERI 2005; NCDC 2004a).

2.3.1.4 Atmospheric Moisture

Precipitation averages about 142 cm (56 in.) per year and is uniformly distributed throughout the year. The months of January, March, April, November, and December average more than 13 cm (5 in.) of precipitation, while the months of June, August, September, and October average less than 10 cm (4 in.). The maximum precipitation in a 24-hour period was 22 cm (8.5 in.) in April 2003. On average, about one third of the days each month experience measurable precipitation. Typically, snow falls almost every year, but only about 4 years in 10 have measurable snowfall. The maximum snowfall in a 24-hour period, 15 cm (6 in.), occurred in January 1982. On occasion, the 24-hour snowfall in the vicinity of Jackson has exceeded 15 cm (6 in.). In January 1940, 27 cm (10.6 in.) was recorded, and in February 1960, 23 cm (9.1 in.) was recorded (NCC 1980).

The 30-year normal relative humidity at Jackson, Mississippi has an annual average of about 75 percent with a diurnal variation in the annual average value from about 91 percent at 6:00 a.m. to about 58 percent at noon (NCDC 2004a). Seasonal variation of relative humidity is small. The 6:00 a.m. monthly average relative humidities range from a minimum of 87 percent in March to a maximum of 95 percent in August. The noon monthly average humidities range from a minimum of 53 percent in April to a maximum of 65 percent in January. Relative humidities for Vicksburg, Mississippi, reported in the environmental report (SERI 2005) are consistent with those for Jackson, Mississippi.

When the relative humidity is near 100 percent, small water droplets (fog) form in the atmosphere and reduce visibility. Records for Jackson indicate that heavy fog, which reduces the visibility to 400 m (0.25 mi) or less can occur in any month. On average, heavy fog occurs on more than 22 days per year with 3 days in December and January, and less than 1 day in

June (NCDC 2004a). The environmental report (SERI 2005) indicates that Vicksburg, Mississippi averages approximately 92 hours per year of fog, with fog defined as reduction of visibility to less than 1 km (5/8 mi).

The combination of wet- and dry-bulb temperatures are used to evaluate the performance of cooling towers. Tables 2.3-16, 2.3-17, and 2.3-18 in the site safety analysis report (SERI 2005) list wet-bulb temperatures and associated dry-bulb temperatures for the 1-, 5-, and 30-day periods with least cooling capacity in a 36-year period of record. For the worst day, the average wet-bulb temperature was 27.2°C (81.0°F) with an average dry-bulb temperature of 30°C (86°F).

2.3.1.5 Severe Weather

The Grand Gulf ESP site can experience severe weather in the form of thunderstorms, snow, ice, tornadoes, and hurricanes. Other significant weather can be associated with these events. For example, lightning, hail, and high winds frequently occur with thunderstorms, and tornadoes can occur with both thunderstorms and hurricanes.

Meteorological records for Jackson, Mississippi, indicate that thunderstorms can be expected on about 68 days per year (NCDC 2004a). Thunderstorms are most frequent in summer. The months of June, July, and August average 9 or more thunderstorm days per year. Months from October through February average fewer than 3 thunderstorm days per year. National Climatic Data Center Storm Data lists 23 hail events with hail 1.9 cm (0.75 in.) or greater in diameter in Claiborne County since 1971 (NCDC 2004b). This number is incomplete because no events were listed from 1972 through 1982.

On average, hurricanes strike the Gulf Coast along the Louisiana and Mississippi coastlines several times a decade. The Grand Gulf ESP site is sufficiently far inland that the strength of storms generally diminishe to less than hurricane strength by the time they reach the vicinity of the site. For example, the remnants of Hurricane Ivan passed near the site in September 2004, and the remnants of Hurricanes Katrina and Rita passed near the site in August and September 2005. In each instance, the sustained winds in the storms were barely at or below hurricane force when the storm passed the site.

The NRC staff has conducted an independent assessment of tornadoes in the vicinity of the Grand Gulf ESP site using National Climatic Data Center data for 1950 through August 2003 (Ramsdell 2004). For this time period, there were 592 tornado events within the two-degree box centered on the Grand Gulf ESP site. Given the distribution of areas associated with the events, it is estimated that the expected probability of a tornado striking the site is approximately 7.4 x 10^{-4} yr^{-1} with 95 percent confidence that the strike probability is less than 9.4 x 10^{-4} yr^{-1}. A tornado struck the Grand Gulf site on April 17, 1978. Detailed reports of this event are included in the GGNS *Updated Final Safety Analysis Report* (Entergy 2003c).

2.3.2 Air Quality

The Grand Gulf ESP site is in Claiborne County, Mississippi, which is on the western edge of the Mobile, Alabama-Pensacola, Florida-Panama City, Florida-Southern Mississippi Interstate air quality control region. The area across the Mississippi River from the site is in the Monroe, Louisiana-El Dorado, Arkansas Interstate air quality control region. None of the counties in these air quality control regions have been designated as in nonattainment of the National Ambient Air Quality Standards (40 CFR 81.325; 40 CFR 81.319). There are no mandatory Class 1 Federal Areas where visibility is an important value within 160 km (100 mi) of the proposed Grand Gulf ESP site.

The Mississippi Department of Environmental Quality (MDEQ) conducts air quality monitoring throughout the State. However, no monitoring is conducted in Claiborne County. The closest monitoring site is in Vicksburg, where the State monitors ozone and particulate matter smaller than 2.5 micrometers. Monitoring results for Vicksburg, Mississippi, for 2001, 2002, and 2003 demonstrate that concentrations of these pollutants are well below National and Mississippi Ambient Air Quality Standards (MDEQ 2002a, 2003, 2004a). More extensive monitoring is conducted in Jackson, Mississippi, with similar results.

The Air Quality Index (AQI) is a national standard method for reporting air pollution levels for the general public. The AQI is based on comparison of the concentrations of six pollutants with National Ambient Air Quality Standards. The six pollutants are ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter smaller than 10 micrometers, and particulate matter smaller than 2.5 micrometers. The air pollution level for each day is placed in one of six categories based on the AQI. In order of decreasing air quality, the categories are Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous.

Jackson is the only location in Mississippi for which AQIs are summarized by MDEQ. According to the MDEQ, the air quality in Jackson was classified Good or Moderate for all of 2001 and 2003 (MDEQ 2002a, 2003, 2004a). In 2002, the average air quality was Good or Moderate for all months, but the air quality did decrease to Unhealthy for Sensitive Groups at least one day in September.

All of the areas, for which monitoring data and AQIs exist, are more densely populated than Claiborne County and the area around the Grand Gulf ESP site. Consequently, air quality at the Grand Gulf ESP site should be better than indicated by the monitoring data and AQIs.

2.3.3 Meteorological Monitoring

Entergy Operations, Inc. and its predecessors have had a meteorological monitoring program at the Grand Gulf site since March 1972. In August 1972, meteorological instrumentation was installed on a permanent tower approximately 1500 m (5000 ft) north-northwest of Unit 1 to provide onsite meteorological information required for licensing of the GGNS. This instrumentation is described in the GGNS Final Environmental Statement (AEC 1973) and in SERI's environmental report (SERI 2005). In December 2000, the tower and instrumentation were replaced by a new tower and state-of-the-art instrumentation. The new tower is located approximately 1.6 km (1 mi) northwest of the control building. The new instrumentation and data collection system are described in detail in the environmental report (SERI 2005) and summarized below.

The meteorological monitoring system consists of a 50-m (162-ft) tower, meteorological instrumentation at the 10-m (33-ft) and 50-m (162-ft) levels of the tower, surface meteorological instrumentation, and data collection and processing equipment. Instrumentation at the 10-m (33-ft) level of the tower measures wind direction, wind speed, temperature, and relative humidity. Instrumentation at the 50-m (162-ft) level measures wind direction, wind speed, and temperature. The temperature difference between the two levels is also determined. A tipping-bucket rain gage is located near the base of the tower. A 10-m (33-ft) backup meteorological tower measures wind direction, wind speed, and temperature at the 10-m (33-ft) level.

Signals from the instruments are sent to the facility's data computer at about 10-second intervals. They are also recorded in data storage modules in a small building near the base of the tower. Each datum is checked to determine whether it is within instrument limits. Fifteen-minute and hourly averages are calculated for each parameter. In addition, 15-minute and 1-hour average values of sigma theta (standard deviation of the wind direction fluctuations) are calculated from the wind direction data. These data (observations and averages) are available to the control room and facility personnel.

The meteorological instrumentation is inspected routinely to ensure that no damage has occurred to the tower or instrumentation and that the instruments are operating properly. These routine inspections are supplemented by semiannual calibration of instruments on the primary tower, check of the tension of tower cables, and visual inspections of wiring. Overall data recovery rates for the meteorological instrumentation for 2001, 2002, and 2003 were 98 percent, 99 percent, and 96 percent, respectively (SERI 2005).

The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collection under the Entergy Operations, Inc. program. Based on this information, the staff concludes that the program provides data that represent the onsite meteorological characteristics as required by

10 CFR 100.20(c). The data also provide an acceptable basis for making estimates of atmospheric dispersion for the evaluation of the consequences of routine and accidental releases required by 10 CFR 50.34(a)(1) and 10 CFR Part 50, Appendix I. If continued, the Entergy Operations, Inc. meteorological monitoring program for the GGNS is suitable for preoperational and operational monitoring as outlined in the *Environmental Standard Review Plan 6.4* (NRC 2000).

2.4 Geology

A description of the geological, seismological, and geotechnical conditions at the Grand Gulf ESP site is provided in Section 2.5 of SERI's site safety analysis report (SERI 2005). Subsurface investigations performed in 2002 as part of the ESP application provided additional information. These involved engineering, geologic, and geotechnical site investigations performed for the proposed location of the new facility to characterize site conditions.

The Grand Gulf ESP site lies within the Mississippi Alluvial Plain Section of the Coastal Plain Physiographic Province. Several important aquifer systems are in the vicinity of the Grand Gulf ESP site including: Mississippi River Valley Alluvial Aquifer system, Coastal Lowlands Aquifer system, and the Mississippi Embayment Aquifer system. The site is south of the southern extent of the Mississippi River Valley Alluvial Aquifer system. However, the site is within the very northern extent of the Coastal Lowlands Aquifer system and in the center of the Mississippi Embayment Aquifer system.

The Coastal Lowlands Aquifer System consists of a gulfward-thickening, heterogeneous, unconsolidated to poorly consolidated wedge of discontinuous beds of sand, silt, and clay that range in age from Oligocene to Holocene. Beneath the Coastal Lowlands Aquifer System is the Mississippi Embayment Aquifer System. At the site, the Mississippi Embayment Aquifer System consists of several aquifers that range from late Cretaceous to middle Eocene in age with a combined thickness of over 1500 m (5000 ft).

During the subsurface investigation completed for the existing Grand Gulf Unit 1, 275 borings were drilled within the site area to a maximum depth of 136 m (447 ft). An additional 3 borings were performed as part of SERI's ESP site characterization activities. These borings provide the basis of the description of the stratigraphy at the Grand Gulf ESP site.

The bluffs at the site delineate a change in the upper stratigraphy. The upland plain, east of the bluffs, is a Pleistocene terrace rising to an elevation of about 46 m (150 ft) above MSL. The surface of the upper plain is about 23 m (75 ft) of loess overlaying about 12 m (40 ft) coarse-grained alluvial sand and gravel deposits of the Upland Complex. The lowland, west of the bluffs, at an elevation of about 21 m (70 ft) above MSL consists of a layer of Holocene alluvium over 30 m (100 ft) in thickness including backswamp areas and meander belts of the

Mississippi River. The Catahoula formation underlies both the terrace deposits in the uplands and the alluvium in the lowlands. The ESP facility would be located in the uplands portion of the site.

At this time, a plant design has not been selected, and the exact footprint and embedment depth of the plant have not been determined. After a plant design has been selected, additional site exploration, laboratory testing, and geotechnical analyses would be performed to develop final plant design criteria for the CP and COL phase of the project.

No activity involving exploration, drilling, or otherwise extracting minerals occurs at the Grand Gulf site. Past unsuccessful exploratory activities on or near the Grand Gulf site and the geological character of the subsurface structure in the vicinity of the Grand Gulf site indicate that commercial mineral production appears unlikely in the foreseeable future (see environmental report in SERI 2005).

2.5 Radiological Environment

A radiological environmental monitoring program (REMP) has been conducted around the Grand Gulf site since 1978. The preoperational program established information on background radiation in the environment (AEC 1973). After GGNS Unit 1 began operation in 1985, Entergy Operations, Inc. and its predecessors monitored the following: air, water, sediment, fish and food products, and direct radiation. Milk is also sampled when there is commercial milk production within 8 km (5 mi) of the site. The REMP has indicator and control locations within a 29-km (18-mi) radius of the site. Sample results from the indicator locations are compared to the control locations and preoperational data to determine (1) pathways for radionuclides released into the environment, (2) potential buildup of long-lived radionuclides, and (3) potential exposure to plants and animals. The results of this monitoring are documented in an annual environmental operating report for GGNS. The staff reviewed historical data from the REMP reports for the past 3 years and found that environmental measurements of this time period were similar to those during the preoperational monitoring phase (Entergy 2002b, 2003b, 2004b).

Each year, Entergy issues a report titled “Annual Radioactive Effluent Release Report,” which documents gaseous and liquid releases and potential doses from GGNS. The staff reviewed annual radioactive effluent release reports for calendar years 2001, 2002, and 2003 (Entergy 2002a, 2003a, 2004a). Maximum doses to a member of the public were calculated using effluent concentration and historical annual average meteorological data for the site. For the 3 years of data reviewed, the maximum annual dose to a member of the public was estimated to be 0.017 mSv (1.7 mrem). The data showed that doses to the maximally exposed individuals around GGNS were a small fraction of the limits specified in Federal environmental radiation standards (10 CFR Part 20; 10 CFR Part 50, Appendix I; 40 CFR Part 190). In addition to the environmental monitoring program conducted by GGNS, information on Mississippi's environmental monitoring program was reviewed.

2.6 Water

This section describes the hydrological processes and physical site features that define the movement, distribution, and quality of surface water and groundwater at the Grand Gulf ESP site. Additionally, this section describes the current and likely future uses of water at the site to meet the various water needs of the population in the vicinity. The existing GGNS plant has significantly altered the local hydrological environment and is included as a key feature of the affected environment. Hydrological, thermal, and chemical monitoring programs for the existing GGNS provide an important source of information for understanding the current environmental baseline and the likely incremental impacts of the Grand Gulf ESP facility on the water resources in the vicinity.

2.6.1 Hydrology

This section describes the site-specific and regional hydrological features of the existing environment that could be altered by the construction, operation, or decommissioning of the proposed new facility. A description of the site's hydrological features was presented in Section 2.3.1 of the environmental report (SERI 2005). The hydrological features of the site related to site safety (e.g., probable maximum flood) are described by SERI in the site safety analysis report portion (Part 2) of the application (SERI 2005).

The site has three primary hydrological areas. The first is the Mississippi River, the dominant hydrological feature of the vicinity. The second is the lowlands between the bluffs and the Mississippi River. The third is the uplands area east of the bluffs. These three areas can be seen in Figure 2.2. In the following sections, the surface and subsurface hydrology are discussed for each of the three areas. Additionally, surface and subsurface hydrological monitoring programs are discussed.

2.6.1.1 Surface Water Hydrology

Mississippi River

With an average discharge of 16,800 m^3/s (593,000 cfs) draining 2,980,000 km^2 (1,150,000 mi^2), the Mississippi River is the largest river in the United States. The western boundary of the Grand Gulf site is defined by the Mississippi River's eastern bank. At the site, the Mississippi River is about 0.8 km (0.5 mi) wide at low flow and about 2.3 km (1.4 mi) during a typical annual high flow period. The depth of the thalweg of the Mississippi River at the site is

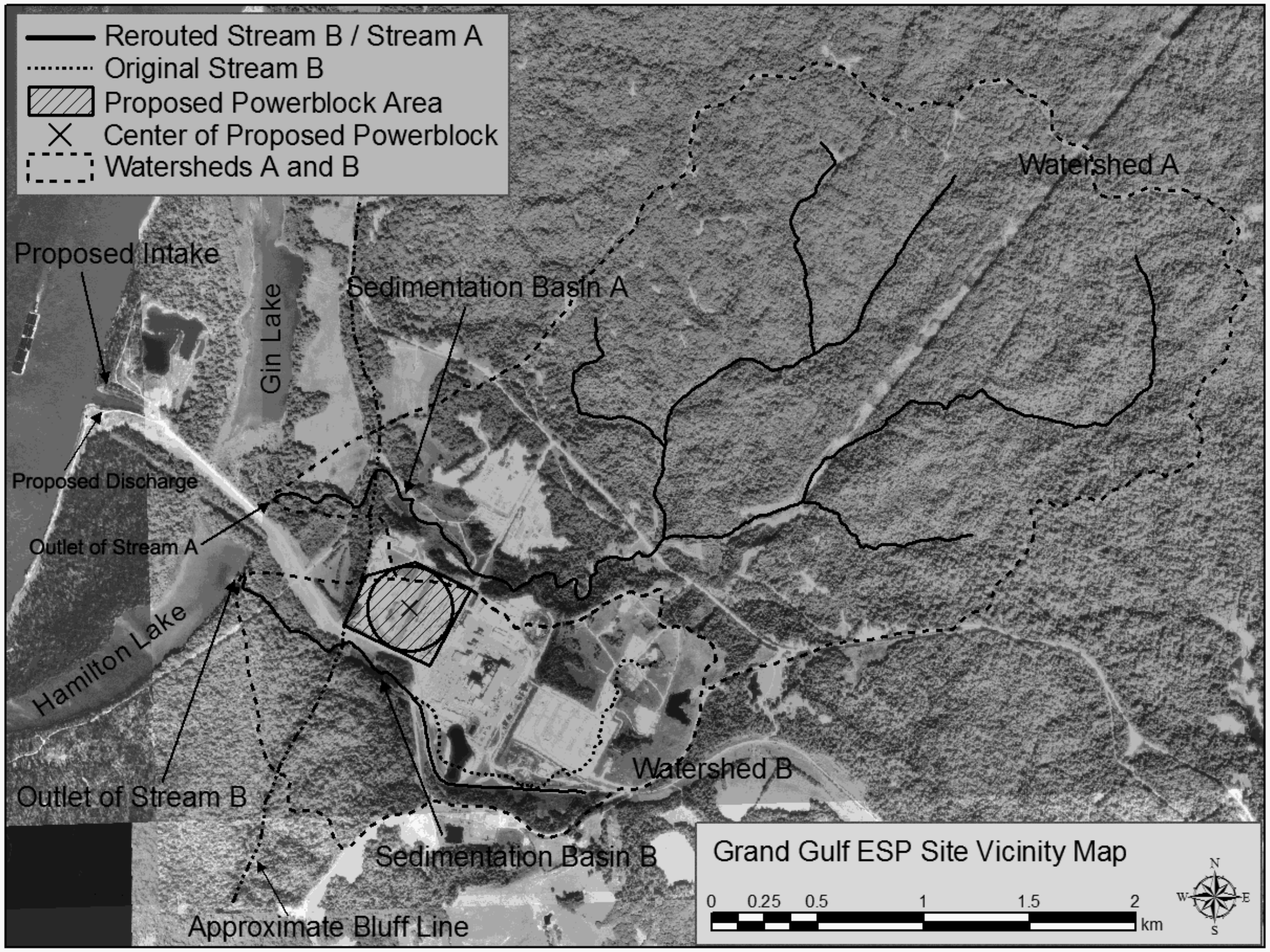

Figure 2-2. Surface Drainage Plan for the Grand Gulf Early Site Permit Site

about 4.9 m (16 ft) below MSL. Historically, the Mississippi River near the site has been very active with frequent changes in the channel alignment and thalweg (Schumm et al. 1994).

However, the Mississippi River is now subject to the management and control of the U.S. Army Corps of Engineers (ACE). Through an aggressive and ongoing program of dredging, installation of river bank revetments and armor, levee construction and maintenance, and upstream reservoir regulation, the ACE has stabilized the historical movement of the river into a relatively stable channel alignment. The bluffs at the Grand Gulf site represent a natural levee and have confined the river, even during pre-channelization times, to stay to the west of the Grand Gulf ESP site.

The Mississippi River flow varies considerably throughout the year and between years. Based on streamflow data from Vicksburg, Mississippi, from 1929 through 1983, the 7-day, 10-year low flow and 100-year flood have been estimated at 3400 m^3/s (120,000 cfs) and 62,380 m^3/s (2,203,000 cfs), respectively (van der Leeden et al. 1990). February, March, April, and May are the months with the highest mean monthly discharges and as such are the periods that the river would most likely rise over its normal banks inundating the adjacent lowland floodplain.

Lowland Plain

The lowland plain of the Grand Gulf ESP site is the area between the Mississippi River and the bluffs. With an elevation of about 20 m (70 ft) above MSL, the lacustrine or palustrine wetlands of the lowlands are subject to nearly annual inundation by the Mississippi River. In periods when the Mississippi is not inundating the lowlands, movement of water through the lowlands is primarily associated with the streamflow of small tributaries that drain the uplands into Hamilton Lake before joining the Mississippi River. Both Gin Lake and Hamilton Lake, within the lowlands, show the characteristics of shallow oxbow lakes formed by the historic migration of the Mississippi River. Construction of a haul road from the GGNS site to the Mississippi River divided the lowlands. A buried pipeline follows the path of the haul road and discharges GGNS's cooling tower blowdown to a small embayment along the Mississippi River. The GGNS intake and discharge pipelines follow the haul road.

Uplands

Based on digital topographic data, the staff delineated the two upland watersheds and their associated stream channels as shown in Figure 2-2. These watersheds correspond closely to those presented by SERI in the environmental report (SERI 2005). Following the naming convention used by SERI, the two watersheds are called "A" and "B." Watershed A lies to the north of Watershed B. The staff estimated the areas of Watershed A and Watershed B as 7.61 km^2 (2.94 mi^2) and 1.76 km^2 (0.68 mi^2), respectively.

The watersheds are very distinct in nature. Whereas Watershed A is mostly covered with a dense canopy of trees and brush, the majority of Watershed B has been cleared of vegetation for the GGNS site. The stream channel in Watershed A follows its natural course, whereas the course of the stream channel in Watershed B has been altered, and the channel lined to provide drainage for the GGNS site. The alterations to Watershed B have resulted in it behaving more like urban watershed with flashy responses to rainfall with little or no baseflow, whereas Watershed B responds like a forested watershed with a more attenuated response to rainfall and continuous baseflow.

Sedimentation basins were constructed on both stream channels downstream from the existing site. However, because of the greater flow and higher sediment load, the sediment basin on Stream A has been filled with sediment and now represents more of a constructed wetland than a basin to trap sediment. Because of the lower flow and lower sediment yield, the sediment basin in Watershed B remains a viable trap for sediment.

The local precipitation is relatively uniform throughout the year. With an average annual precipitation of 130 cm (53 in.), eight months have average monthly precipitation of 10 to 15 cm (4 to 6 in.) and four months have average monthly precipitation of 5 to 10 cm (2 to 4 in.). March and October are the months with both the highest and lowest monthly average precipitation and runoff, respectively. Because of the relatively warm winters, the region experiences little precipitation as snow.

2.6.1.2 Groundwater Hydrology

Several important aquifer systems are in the vicinity of the proposed site including: Mississippi River Valley Alluvial Aquifer system, Coastal Lowlands Aquifer system, and the Mississippi Embayment Aquifer system. The site is within the very northern extent of the Coastal Lowlands Aquifer system and in the center of the Mississippi Embayment Aquifer system.

During the subsurface investigation completed for the existing Grand Gulf Unit 1, 275 borings were drilled within the site area to maximum depth of 136 m (447 ft). An additional 3 borings were performed as part of SERI's ESP site characterization activities. These borings provide the basis of the description of the stratigraphy at the Grand Gulf ESP site.

At this time, a plant design for the ESP site has not been selected, and the specific footprint and embedment depth of the plant have not been determined. After a plant design has been selected, additional site exploration, laboratory testing, and geotechnical analyses would be performed to develop final plant design criteria for the CP or COL phase of the project (SERI 2005).

Mississippi River

The morphology of the Mississippi River has defined much of the alluvial aquifer system near the site. The Holocene alluvium near the river has been affected by deposition and erosion. Faster-moving sections of the river are able to scour and cut down to the Catahoula formation, whereas slower-moving sections of the river provide an opportunity for the sediment in the river to deposit.

Beneath and adjacent to the river, the alluvium is in close hydraulic connection with the river. The fluctuation of the Mississippi River causes fluctuation in the alluvial aquifers. Generally, at the site the alluvium discharges to the river. However, during floods the direction of flow in the alluvial aquifers can reverse.

The GGNS cooling system uses radial (Ranney) wells reaching out beneath the Mississippi River stream bed to induce river water to migrate through the alluvium to the collectors. The connection between the alluvium and the river means that the existing plant is essentially using river water and not groundwater. The radial well system lets the existing plant use the alluvial aquifer to filter out the sediment in the river water without resulting in significant impacts to the local groundwater resources.

Lowland Plain

The bluffs at the site delineate a change in the upper stratigraphy. The upland plain, east of the bluffs, is a Pleistocene terrace rising to an elevation of about 46 m (150 ft) above MSL. The lowland, west of the bluffs, at an elevation of about 20 m (70 ft) above MSL, consists of a layer of Holocene alluvium more than 30 m (100 ft) thick, including backswamp areas and meander belts of the Mississippi River. The Miocene Catahoula formation underlies the alluvium in the lowlands.

In addition to the effect of the Mississippi River, infiltration from local precipitation and shallow surface water bodies, such as Gin Lake and Hamilton Lake, can recharge the lowland alluvial aquifer. The unconfined water surface in the alluvial aquifer in the lowlands is at most a few feet beneath the ground surface. The aquifers in the deeper Catahoula formation are more likely to be recharged via lateral flow from outcrops a distance from the site.

Upland

The surface of the upper plain is about 23 m (75 ft) of loess overlaying about 10 m (40 ft) coarse-grained alluvial sand and gravel deposits of the Upland Complex. The unconfined aquifer in the loess and alluvium is recharged from local precipitation and lateral movement. The water table elevation is not significantly influenced by the fluctuations in the Mississippi River. The Catahoula formation underlies the terrace deposits in the upland.

2.6.1.3 Hydrological Monitoring

Preoperational and ongoing operational monitoring of the GGNS facility provide a limited hydrological baseline of the affected environment within and near the Grand Gulf ESP site. Many of the construction impacts of an ESP facility at the site are likely to be similar to the impacts that occurred during construction of the existing plant. For instance, groundwater drawdowns caused by dewatering wells are likely to have similar impacts to the impacts experienced and monitored during the construction of the GGNS facility. These impacts were temporary and localized to the GGNS site.

The flow and water surface elevation of the Mississippi River are continuously monitored by the ACE. The ACE operates a station at Vicksburg (Station #15145) and a station downstream from the site at Natchez, Mississippi (Station #15155). The ACE also publishes a hydrographic survey, including the maps of the riverbed elevations of the Mississippi River adjacent to the site.

As part of the GGNS National Pollutant Discharge Elimination System (NPDES) permit, streamflows are monitored on Stream A and Stream B downstream of Sedimentation Basin A and Sedimentation Basin B, respectively. For Stream A, SERI reported annual average flows of 0.00954 m^3/s (0.337 cfs) for 1999 and 0.0934 m^3/s (3.30 cfs) for 2001. For Stream B, SERI reported annual average flows of 0.00832 m^3/s (0.294 cfs) for 1999 and 0.0138 m^3/s (0.487 cfs) for 2000 (SERI 2005). Additionally, flows are recorded for each of the outfalls from the GGNS facility discharging into Sedimentation Basin A, Sedimentation Basin B, and directly into the Mississippi River.

Total annual water withdrawals from radial wells adjacent to the Mississippi River, dewatering wells, and wells in the Catahoula formation for potable water supplies are reported to the MDEQ. The staff reviewed annual water use reports obtained from MDEQ for 2000 and 2002 and found that the radial wells and potable wells were operating well below their rated capacities and the dewatering wells were not being used at all during these two years.

According to the safety analysis report, groundwater levels were initially measured in 1972 with 15 piezometer and 36 observation well locations (SERI 2005). The number of locations in the Catahoula formation, terrace deposits, and alluvium was 10, 33, and 8, respectively. These data reported by SERI for 1972 through 1976 provide a baseline for the pre-GGNS groundwater elevations. The data show both inter-annual and intra-annual variation in the three strata of as much as 12 m (40 ft). While the magnitude of water surface changes vary considerably between wells, generally the direction of water surface change is consistent (i.e., all wells and strata increase and decrease together), suggesting that the three strata have some degree of hydraulic connection.

Water levels in one piezometer, nine observation wells, seven monitoring wells and eight dewatering wells in the Catahoula formation, terrace deposits, and alluvium are measured monthly. The number of locations in the Catahoula formation, terrace deposits, alluvium, and perched aquifers in the fill around the GGNS reactor block are 2, 5, 2, and 15, respectively. The environmental report (SERI 2005) contains recent groundwater sampling data from published sources and from results of ongoing monitoring programs at the GGNS site.

The NRC staff found the hydraulic conductivity information from various permeability tests reported by SERI for the Catahoula formation is currently inadequate to provide a reliable basis to estimate the groundwater drawdowns associated with withdrawals from this formation. However, other than this exception, the staff found that continuation of the existing monitoring program would provide an adequate hydrological monitoring program.

2.6.2 Water Use

Water in the vicinity satisfies a variety of purposes including domestic, industrial, and agricultural uses with groundwater withdrawn from the various aquifers and surface water withdrawn from the Mississippi River. SERI presented estimated water use data for 1995 in Claiborne County (SERI 2005). The NRC staff used 2000 data from the USGS (USGS 2004). The staff found that total estimated water use in Claiborne County was 130,000 m^3/d (34.3 MGD). Groundwater comprises all of that total except 1600 m^3/d (0.4 MGD) of surface water.

2.6.2.1 Surface Water Use

Although surface water is not directly used at the existing GGNS, the facility withdraws groundwater that is hydraulically connected to the river, as further described below. Total surface water withdrawals in Claiborne County are predominantly for agricultural use, with no surface water usage reported for public supply, domestic self-supplied systems, mining, hydroelectric power, thermoelectric power, industrial or commercial uses (see environmental report in SERI 2005).

The nearest downstream user of Mississippi River water is Southeast Wood Fiber located at the Claiborne County Port facility, 1.3 km (0.8 mi) downstream of the Grand Gulf ESP site. The maximum intake requirement for this facility is less than 3400 m^3/d (0.9 MGD) for industrial purposes; however, none of this intake is used as potable water (MDEQ 2004b). According to the environmental report, there are only three public water supply systems in the state of Mississippi that use surface water as a source, and none of these are located within 80 km (50 mi) of the Grand Gulf ESP site (SERI 2005). There are no downstream or upstream intakes in Mississippi within 160 km (100 mi) of the Grand Gulf ESP site that use the Mississippi River as a potable water supply (MDEQ 2002b).

The ACE maintains a depth of 3 m (9 ft) at low water on the Mississippi River for navigational uses.

2.6.2.2 Groundwater Use

Service water for the existing GGNS is supplied from radial (Ranney) collector wells located beneath and adjacent to the Mississippi River. The collector wells pump water from the Mississippi alluvial aquifer via induced infiltration from the Mississippi River (Entergy 2003c).

Total groundwater withdrawal in Claiborne County for 2000 was 128,000 m^3/d (33.9 MGD), with the majority used for cooling at GGNS.

Entergy Operations, Inc. is required to submit an Annual Water Use Survey to the MDEQ. According to data for the 2003 calendar year, the GGNS has seven active wells with a total of 0.116 million L/d (30.8 MGD) pumped in 2003. All of this water was pumped from the four radial collector wells, except 0.302 million L/d (0.08 MGD) pumped from three wells in the Catahoula formation used for general site purposes, including potable, sanitary, air conditioning, and landscape maintenance.

Public water supply wells in Claiborne County, excluding GGNS, are supplied from the Catahoula formation. Nine active public water supply systems were located in Claiborne County as of July 2004 (EPA 2004). The closest area of concentrated groundwater withdrawal is the Port Gibson municipal water system about 8 km (5 mi) southeast of the site. It pumps from five wells completed in the Catahoula formation and is the largest system in the county, serving a population of 4845. Within 3.2 km (2 mi) of the Grand Gulf ESP site, essentially all groundwater is used for domestic purposes.

SERI estimated future groundwater demands in the vicinity of the site on the basis of projected population growth. According to the population projections (see the environmental report in SERI 2005), the population within a 3.2-km (2-mi) radius of the Grand Gulf ESP site will increase by 14 percent to 58 persons by the year 2070 (excluding Grand Gulf plant personnel). Current water use in this area is primarily for domestic consumption (SERI 2005). Conservatively assuming the entire projected population used groundwater as a source, and each person used 382 L/d (101 GPD) (Carr et al. 1990), the estimated groundwater withdrawal within a 3.2-km (2-mi) radius of the Grand Gulf ESP site by the year 2070 will be 22,200 L/d (5860 GPD). Much of that groundwater consumption would likely return to the surficial aquifer via septic drainfields. A listing of water wells within a 6.4-km (4-mi) radius of the Grand Gulf ESP site can be found in the environmental report (SERI 2005).

2.6.3 Water Quality

Surface water and groundwater quality in the vicinity of the ESP site are adequate for a variety of uses. The water quality of the Mississippi River and the two small onsite drainages, Stream A and Stream B, has been slightly altered by the construction and operation of the GGNS facility. The induced infiltration from the operation of the GGNS radial wells has ensured that the quality of the groundwater in the vicinity of the radial wells is nearly identical to the water quality of the Mississippi River, except for suspended sediment. The water quality of the groundwater in the Catahoula formation does not appear to have been influenced by the construction or operation of the GGNS facility.

2.6.3.1 Surface Water Quality

The Mississippi River integrates the qualities of all its multitude of inflows throughout its course to the Grand Gulf site. The massive nature of the Mississippi River makes the discharges from the GGNS facility undetectable within the overall flow regime, and any changes in the quality are small and localized compared to the overall width of the river. The water quality of the Mississippi is monitored by the ACE at Vicksburg, Mississippi upstream of the Grand Gulf ESP site. Temperatures in the Mississippi River vary seasonally with maximum and minimum temperatures reported as 32°C (90°F) and 1.5°C (35°F), respectively. The Mississippi River water is generally hard to very hard and therefore requires softening to avoid scale formation when heated.

At the Grand Gulf site, water quality of Streams A and B (see Figure 2.2) is affected by the GGNS facility. Stream A is generally unaffected by the GGNS facility until it reaches Sedimentation Basin A. At this location, discharges include: storm water runoff, standby service water leakage, treated sanitary waste water, and miscellaneous waste water from the GGNS Energy Services Center, including water softener backwash and air-conditioning cooling tower blowdown. These sources contribute nutrients, chlorine, and sediment to the sedimentation basin. In compliance with its NPDES permit, Entergy Operations, Inc. is required to monitor these. The maximum monthly average nutrient concentration of the sanitary waste treatment system reported by SERI, expressed in terms of biological oxygen demand, for 2000 and 2001 was 25 mg/L. The maximum total suspended solids from the combined outflow from Sediment Basin A reported by SERI for 1999, 2000, and 2001 was 97 ppm.

The watershed and channel for Stream B were nearly entirely modified as a result of the construction of the GGNS facility. The water quality of Stream B has been altered by the loss of the vegetation and soil cover. The normal nutrient and sediment load from a forested watershed have been reduced by the loss of the canopy and changes of the surface runoff conditions. Sedimentation Basin B also receives standby service water leakage, intermittent circulating water basin overflows, storm water runoff, and water from a variety of building drains. Entergy Operations, Inc. is required by its NPDES permit to monitor these sources. The maximum amount of total suspended solids in the combined outflow from Sedimentation Basin B reported by SERI for 1999, 2000, and 2001 was 26 ppm.

2.6.3.2 Groundwater Quality

The GGNS facility uses radial wells adjacent to and with laterals extending beneath the Mississippi River to provide cooling water. The high rate of water induced to infiltrate from the Mississippi River into the Holocene alluvium has ensured that the dissolved solids concentrations of the groundwater in the vicinity of the radial wells are nearly identical to the water quality of the Mississippi River. Suspended sediment in the river water is trapped in the stream bed, thereby reducing the suspended solids in the cooling water. The water quality of the groundwater in the Catahoula formation does not appear to have been influenced by the construction or operation of the GGNS facility.

The GGNS uses wells in the Catahoula formation as the source of water for several purposes, including potable water needs. The water is sampled for the Mississippi Health Department pursuant to the Safe Drinking Water Act. The water quality of the groundwater from the Catahoula formation, although very hard, is suitable for potable uses. Water quality generally decreases as wells go deeper below the Catahoula formation.

2.6.3.3 Thermal Monitoring

Pre-application, pre-operational, and ongoing operational monitoring of the GGNS facility provide a limited baseline of the temperatures in the Mississippi River. The operational impact of the additional thermal load in the cooling tower blowdown from the Grand Gulf ESP facility would be additive to the thermal impact of the GGNS facility. It is expected that the discharge volume would increase, but discharge temperature would not change. Therefore, the existing thermal plume would increase in area, but would not have a higher maximum temperature. Adequate temperature baseline data can be developed from the existing plant's discharge to calibrate and validate thermal plume models such as CORMIX. (See Section 5.3.2 for a discussion of the thermal analysis performed by the NRC staff using the CORMIX model.)

The NRC staff found the thermal plume data for the existing GGNS discharge are currently inadequate to calibrate the CORMIX model. Pursuant to Section 316(a) of the Clean Water Act, an applicant for a CP or COL may be required by MDEQ to collect sufficient temperature data to calibrate the CORMIX model. Other than this exception, the staff found that continuation of the existing operational monitoring program would provide an adequate thermal monitoring program for a new power generation facility at the Grand Gulf ESP site.

2.6.3.4 Chemical Monitoring

Pre-application, pre-operational, and ongoing operational monitoring of the GGNS facility provide a limited water quality baseline of the affected environment within and near the proposed Grand Gulf ESP site. Many of the operational impacts of an ESP facility at the site are likely to be similar to the impacts that are occurring as a result of the existing plant. For instance, nutrient loads to Sedimentation Basin A from the sanitary treatment system are likely to increase proportionally to the increase in staff for both facilities. The current water quality baseline data can be used to calibrate and validate mixing models such as CORMIX. (See Section 5.3.2 for a discussion of the chemical mixing analysis performed by the staff using the CORMIX model.)

As no specific design has been selected for the ESP facility, water treatment and waste water designs are currently unknown. Water treatment is likely to be required to improve the quality of water withdrawn from the Mississippi River that is proposed to be used in the closed-cycle cooling system. Other than the sanitary effluents, there currently is no basis to evaluate the suitability of the current monitoring program to fit the needs of the liquid effluents from a new ESP facility. Prior to operation, the applicant for a CP or COL at the Grand Gulf ESP site would be required to define the effluents and obtain an NPDES permit from MDEQ.

2.7 Ecology

The vast majority of the Grand Gulf site has been left undisturbed since construction of GGNS Unit 1. The site is roughly bisected by a north-south line of bluffs located parallel to and east of the Mississippi River. The Grand Gulf site consists of seasonally inundated bottomland west of the bluffs along the river and uplands atop the bluffs. About one-half of the site is bottomland, including forested, shrub, and emergent marsh wetlands. The other half of the site supports upland habitat, including forests, fields, and small wetlands, in areas that were not cleared during construction of GGNS Unit 1. The Grand Gulf ESP site consists primarily of upland hardwood forest and bottomland forested wetlands. Generally, wildlife species found on the Grand Gulf site are representative of those commonly found in central Mississippi and northern Louisiana along the Mississippi River.

Sections 2.7.1 and 2.7.2 provide general descriptions of terrestrial and aquatic environments on and in the near vicinity of the Grand Gulf site. Detailed descriptions are provided where needed to support the analysis of potential environmental impacts from construction, operation, and decommissioning of new nuclear power generating facilities. The descriptions are provided to support mitigation activities identified during the assessment to avoid, reduce, minimize, rectify, or compensate for potential impacts. Descriptions are also provided to help compare the alternative sites to the Grand Gulf site. Also included are descriptions of monitoring programs for terrestrial and aquatic environments.

2.7.1 Terrestrial Ecology

The Grand Gulf ESP site overlaps the Mississippi Valley Alluvial Plain and Mississippi Valley Loess Plains ecoregions as described by Omernik (1987). The Mississippi Valley Alluvial Plain ecoregion consists of a broad, flat alluvial plain with river terraces, swales, and levees providing the main elements of relief. Soils are typically finer-textured and more poorly drained than the upland soils of the adjacent Mississippi Valley Loess Plains ecoregion. Bottomland deciduous forest vegetation covers the Mississippi Valley Alluvial Plain ecoregion where it has not been cleared for cultivation. The Mississippi Valley Loess Plains ecoregion consists primarily of irregular plains, some gently rolling hills, and bluffs near the Mississippi River. Thick loess is one of the distinguishing characteristics. Oak-hickory and oak-hickory-pine forest was the natural vegetation in this ecoregion. In the Mississippi portion of this ecoregion there is a mosaic of forest and cropland (Omernik 1987).

Reconnaissance visits to the Grand Gulf site were made by Enercon Services, Inc. (Enercon), on behalf of SERI, during August 19 to 24 and October 29 to November 1, 2002 (SERI 2005). The purpose of these visits was to identify jurisdictional waters of the United States including wetlands, and qualitatively assess existing ecological resources (including vegetation and wildlife) for comparison with descriptions provided in Mississippi Power and Light's (MP&L's) Final Environmental Report (1973). Information provided in the MP&L Final Environmental Report was based on field surveys conducted from June 1972 to August 1973 prior to construction of GGNS Unit 1 (see environmental report in SERI 2005).

Figure 2-3 is an aerial photograph of the Grand Gulf area taken in 1971, prior to construction of GGNS Unit 1. Figure 2-4 is an aerial photograph taken in 2001 depicting GGNS Unit 1 and proposed construction areas for the Grand Gulf ESP facility. A comparison of Figures 2-3 and 2-4 shows the vast majority of the Grand Gulf site has been left undisturbed since construction of GGNS Unit 1. It is noteworthy, however, that the main channel of the Mississippi River north of the barge slip (Figure 2-4) has moved to the east in the intervening 30 years, as evidenced by the property line extending into the river. This represents a loss of about 34 ha (85 ac) of terrestrial habitat. According to the environmental report, the ACE has stabilized the banks of the river by constructing revetments; therefore, further erosion of the eastern bank is not anticipated (SERI 2005).

The conclusion drawn from the Enercon reconnaissance visits and comparison of Figures 2-3 and 2-4 is that the ecological descriptions in the final environmental report (MP&L 1973) adequately describe current conditions at the Grand Gulf site (see environmental report in SERI 2005). Consequently, the final environmental report descriptions (updated with information to indicate where biological conditions at the Grand Gulf site differ from those in

Figure 2-3. Aerial Photograph of the Grand Gulf Area (October 11, 1971) Prior to Construction of Grand Gulf Nuclear Station Unit 1 Facility (SERI 2005, Figure 2.4-1)

Figure 2-4. Aerial Photograph Depicting Grand Gulf Nuclear Station Unit 1 (November 21, 2001) and Construction Areas (Cross-Hatched Areas) for the Proposed Grand Gulf Early Site Permit Facility (SERI 2005, Figure 2.4-2)

existence prior to construction of GGNS Unit 1) were incorporated into the environmental report for the Grand Gulf ESP (SERI 2005) and are extensively used for the following descriptions of terrestrial ecological resources.

2.7.1.1 Biological Communities

Vegetation on the Grand Gulf Site

About one-half of the Grand Gulf site is bottomland, including forested, shrub, and emergent marsh wetlands. According to the environmental report, the other half of the site supports upland habitat types, including forests, fields, and small wetlands, in areas that were not cleared during construction of GGNS Unit 1 (SERI 2005).

During 1972 and 1973, before the construction of GGNS Unit 1, at least 420 species of vascular plants representing 285 genera and 105 families were observed on the site (MP&L 1973; SERI 2005). The environmental report states that of the 64 tree species, all but three are deciduous (SERI 2005). The composition of understory vegetation varied by location and season, with the largest number of plant taxa occurring in the uplands during the summer, and the smallest number of taxa in the bottomland during winter (SERI 2005). The uplands are more diverse than the bottomland primarily because of the lack of Mississippi River inundation and its scouring effects on understory vegetation. Common plant taxa that were found in upland and bottomland forests are listed in Table 2-4.

Terrestrial habitats at the Grand Gulf site can now, as in the 1970s, generally be classified as upland and bottomland forest, upland and bottomland clearings (since planted with loblolly pine [*Pinus taeda*] and American sycamore [*Platanus occidentalis*], respectively), and upland and bottomland wetlands. The distribution of these habitats, including areas currently developed for GGNS Unit 1 infrastructure and those proposed for construction of the Grand Gulf ESP facility, are shown in Figure 2-5. According to the environmental report, most of the currently developed area is located in the uplands (SERI 2005). The terrestrial habitats on the Grand Gulf site are described in the following paragraphs.

<u>Bottomland Forest</u>

Bottomland hardwood forests may be characterized as palustrine, seasonally flooded wetlands. This habitat covers approximately 358 ha (885 ac), most of the bottomland between the Mississippi River and the bluff line (Figure 2-5). Habitat characteristics of bottomland hardwood forests fluctuate seasonally with varying levels of inundation (SERI 2005).

Table 2-4. Common Plant Taxa in Bottomland and Upland Forests Prior to Construction of Grand Gulf Nuclear Station Unit 1

Bottomland Forest		Upland Forest	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
American buckwheat vine	*Brunnichia ovata*	American elm	*Ulmus americana*
asters	*Aster* spp.	asters	*Aster* spp.
bedstraw	*Galium* spp.	brittle bladderfern	*Cystopteris fragilis*
black willow	*Salix nigra*	crossvine	*Bignonia capreolata*
box elder	*Acer negundo*	eastern poison ivy	*Toxicodendron radicans*
chickweeds	*Stellaria* spp.	grasses	Family Poaceae
fleabanes	*Erigeron* spp.	greenbriars	*Smilax* spp.
dewberries	*Rubus* spp.	haircap moss	Family Musci
eastern poison ivy	*Toxicodendron radicans*	hickories	*Carya* spp.
false nettle	*Boehmeria cylindrica*	Japanese honeysuckle	*Lonicera japonica*
grasses	Family Poaceae	sedges	*Carex* spp., *Cyperus* spp.
green ash	*Fraxinus pennsylvanica*	smallflower baby blue eyes	*Nemophila aphylla*
Johnson grass	*Sorghum halepense*	southern red oak	*Quercus falcata*
pecans	*Carya* spp.	swamp privet	*Forestiera acuminata*
peppervine	*Ampelopsis arborea*	sweetgum	*Liquidambar styraciflua*
sedges	*Carex* spp., *Cyperus* spp.	switchcane	*Arundinaria gigantea*
smallflower baby blue eyes	*Nemophila aphylla*	violets	*Viola* spp.
sugarberry	*Celtis laevigata*	Virginia creeper	*Parthenocissus quinquefolia*
trumpet creeper	*Campsis radicans*	water oak	*Quercus nigra*
vetches	*Vicia* spp.	winged elm	*Ulmus alata*
violets	*Viola* spp.		
Source: SERI 2005			

Herb, forb, and shrub layers are typically sparse because of the closed canopy and because annual inundation by Mississippi River flood water retards vegetation growth. Opening the overstory canopy by means of storms, natural tree-fall, logging, or cultivation promotes growth of sedges, grasses, and other low-growing vegetation, such as panicgrass (*Panicum* spp.), lizard's tail (*Saururus cernuus*), and trumpet creeper (*Campsis radicans*) (SERI 2005).

Bottomland Emergent Wetlands

Bottomland emergent wetlands (dominated by plants that rise above the surface of the water) may be characterized as palustrine and seasonally flooded. These cover approximately 12 ha (30 ac) and are located at the south and north ends of Hamilton Lake (Figure 2-5). These wetlands are dominated by grasses, such as redtop panicgrass (*Panicum rigidulum*), and sedges (*Carex* spp.); their level of inundation varies seasonally and from year to year (SERI 2005).

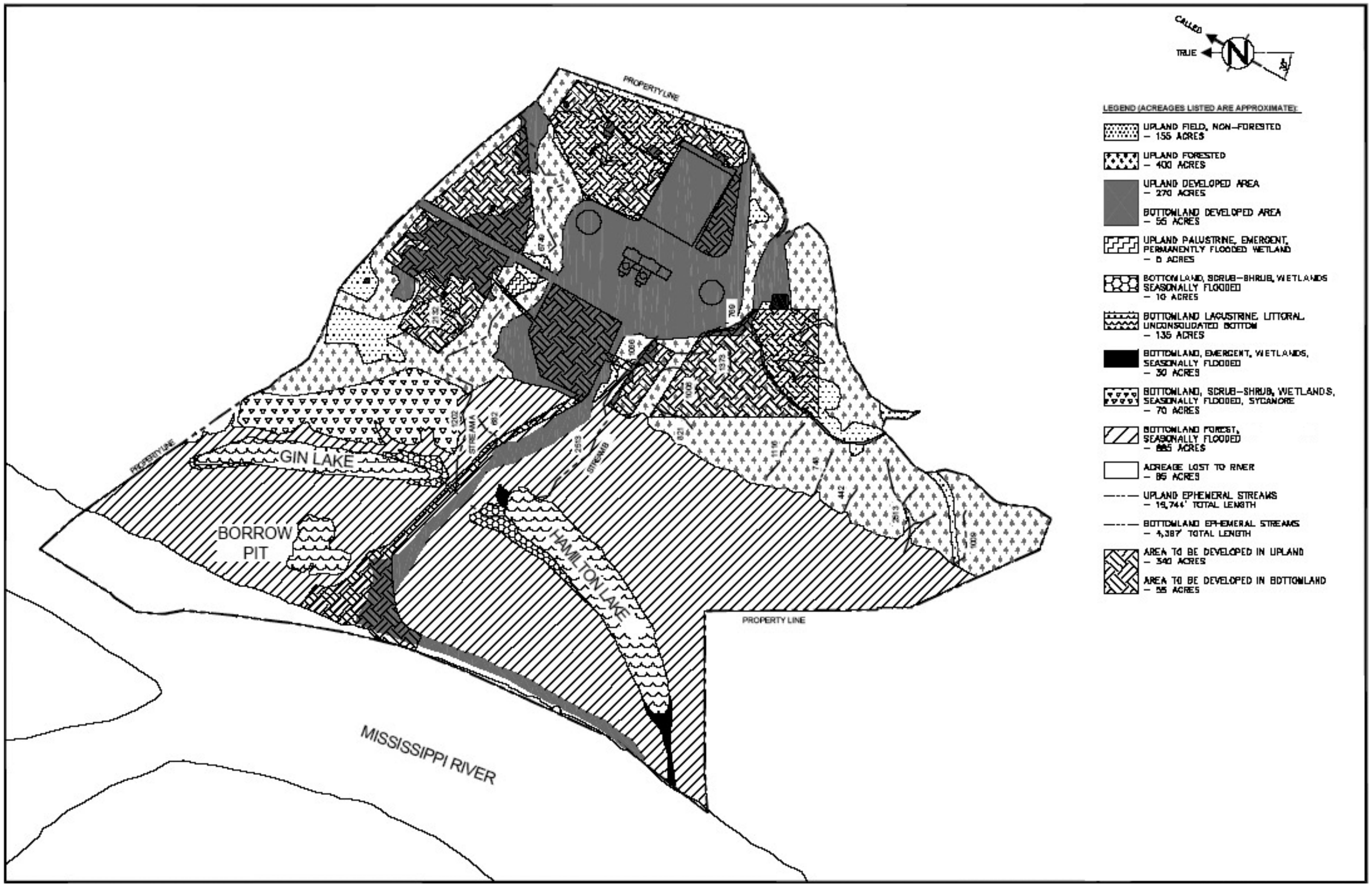

Figure 2-5. Terrestrial Habitat Types and Developed Areas on the Grand Gulf Site (SERI 2005, Figure 2.4-3)

Bottomland Scrub-Shrub Wetlands

Bottomland scrub-shrub (dominated by sapling trees and shrubs) wetlands may also be characterized as palustrine and seasonally flooded. Those located east of Gin Lake (Figure 2-5) cover approximately 28 ha (70 ac) and most likely were a former bottomland field cultivated for forage. The field has been planted with American sycamore trees, which are uniformly about 6 m (20 ft) in height (SERI 2005). In 2002, the perimeter of this area was cultivated to enhance deer habitat and attract deer to the area for hunting (SERI 2005).

Other bottomland scrub-shrub wetlands are located on the north, northwest, and south ends of Gin Lake, and on the northwest bank of Hamilton Lake (Figure 2-5). These cover approximately 4 ha (10 ac) and are dominated by black willow (*Salix nigra*) and swamp privet (*Forestiera acuminata*). Little herbaceous understory vegetation occurs in these wetlands, probably because of recurrent flooding in spring. Common button bush (*Cephalanthus occidentalis*) is found in these wetlands on the south end of Gin Lake (SERI 2005).

Upland Forests

Upland hardwood forests are a combination of two forest community types, oak (*Quercus* spp.)-American elm (*Ulmus americana*) and oak-sweetgum (*Liquidambar styraciflua*) deciduous forest. These dominate upland areas and cover approximately 162 ha (400 ac) (Figure 2-5). Like bottomland hardwood forests, the growth of understory vegetation in upland hardwood forests is limited by canopy closure. However, unlike bottomland forests, upland forests are rarely inundated with water for prolonged periods, so flooding is less a limiting factor on growth of understory vegetation. Consequently, upland forests exhibit a more diverse plant community than bottomland forests, both in structure and taxonomic composition (SERI 2005).

Upland Fields

Upland fields cover approximately 63 ha (155 ac) at the ESP site (Figure 2-5). They have been planted with loblolly pine (SERI 2005).

Vegetation along the Grand Gulf Nuclear Station Unit 1 Transmission Line Rights-of-Way

SERI did not indicate the vegetation communities (including wetland, floodplains, or special habitat areas) crossed by the GGNS Unit 1 transmission line rights-of-way (Baxter-Wilson and Franklin lines) in its environmental report (SERI 2005, 2004d). Further, no such information is available from the transmission and distribution system owner and operator (Entergy Mississippi, Inc.) (Entergy Services 2004a). SERI also did not indicate the transmission line right-of-way maintenance procedures in its environmental report (SERI 2005). However, the procedures generally consist of mechanical means (primarily bushhogging) that are performed on an as-needed basis (Entergy Services 2004b), except for along the Franklin transmission line right-of-way where it crosses the Homochitto National Forest. In 2003, Entergy Corporation entered into a partnership with the National Wild Turkey Federation to maintain transmission line rights-of-way on the Homochitto National Forest using low-toxicity herbicides for the purpose of producing a more open, grassy habitat (USFS 2003).

Wildlife on the Grand Gulf Site

Forests with diverse plant species and well-developed vertical structure provide many ecological niches that support diverse wildlife populations. The majority of the undeveloped portion of the Grand Gulf site consists of bottomland and upland hardwood forests. Hardwood forests, particularly those in the uplands, are diverse. Generally, as hardwood forests increase in age, the structure of their herb, forb, shrub, mid-story, and canopy layers also increases. Bottomland hardwood forests, while they may not be as rich in species as upland hardwood forests, can be highly productive in terms of wildlife, in part because of annual inundation that continually replenishes soil nutrients (SERI 2005).

Hardwood forests provide the requirements of nesting birds, as well as migration corridors and stop-over habitat for neo-tropical and short-distance migrants. Likewise, hardwood forests provide travel corridors for mammals and habitat for other resident, ground-dwelling animals. Of special significance in hardwood forests is the production of beechnuts, acorns, and similar foodstuffs, collectively termed “mast.” Mast is consumed by a variety of wildlife species. Older hardwood stands also feature trees with cavities of varying size that are important as wildlife dens and roosts (SERI 2005).

<u>Mammals</u>

Table 2-5 lists the mammal species encountered on the Grand Gulf site in 1972 and 1973 prior to construction of GGNS Unit 1 (SERI 2005). The whitetail deer *(Odocoileus virginianus)* is the largest of these species. Based on the Enercon October 2002 reconnaissance visit to the Grand Gulf site (SERI 2005), a substantial deer population continues to use both upland and bottomland forests. In October 2002, two areas were observed where a local archery hunting club of SERI employees had disked and seeded the ground with grass to attract wildlife. One area was in a natural clearing in a bottomland forest stand east of Radial Water Well No. 1. The other area was in a former bottomland field northwest of GGNS Unit 1 near Gin Lake. The SERI (2005) environmental report did not specify the sizes of the two treated areas, but they are on the order of several acres and thus comprise only a small portion of the Grand Gulf site.

Table 2-5. Mammals Collected or Observed Prior to Construction of Grand Gulf Nuclear Station Unit 1

Small Mammals		Large Mammals	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Peromyscus gossypinus	cotton mouse	*Dasypus novemcinctus*	armadillo
Tamias striatus	eastern chipmunk	*Castor canadensis*	beaver
Sciurus niger	eastern fox squirrel	*Lynx rufus*	bobcat
Sciurus carolinensis	eastern gray squirrel	*Sylvilagus floridanus*	eastern cottontail
Reithrodontomys fulvescens	fulvous harvest mouse	*Urocyon cinereoargenteus*	gray fox
Ochrotomys nuttalli	golden mouse	*Didelphis marsupialis*	opossum
Sigmodon hispidus	hispid cotton rat	*Procyon lotor*	raccoon
Mus musculus	house mouse	*Mephitis mephitis*	striped skunk
Cryptotis parva	least shrew	*Sylvilagus aquaticus*	swamp rabbit
Microtus pinetorum	woodland vole	*Odocoileus virginianus*	whitetail deer
Oryzomys palustris	marsh rice rat		
Blarina brevicauda	shorttail shrew		
Peromyscus leucopus	white-footed mouse		

Source: SERI 2005

Based on the October 2002 Enercon reconnaissance visit to the Grand Gulf site (SERI 2005), beaver (*Castor canadensis*) use bottomlands and onsite streams, and raccoon *(Procyon lotor),* striped skunk *(Mephitis mephitis)*, and various unidentified small mammals (for example, mice and shrews) use both uplands and bottomlands. Bottomlands are used by hogs. However, whether these are feral domestic hogs *(Sus scrofa)* or collared peccary *(Pecari tajacu)* is unknown (SERI 2005).

Common Bird Species

The list of common bird species observed on or near the Grand Gulf site during the 1972 and 1973 censuses is too long to list here. A complete list can be found in the SERI (2005) environmental report. Instead, groups of birds are discussed in the following paragraphs to provide an overview of the birds using the Grand Gulf site. The species discussed are considered common onsite, except where otherwise noted.

Forest Community Birds

Forest community birds include year-round, summer and winter residents. Examples include: the blue jay (Cyanocitta cristata) and northern cardinal (*Cardinalis cardinalis*), which are year-round residents; the Acadian flycatcher (*Empidonax virescens*) and yellow-billed cuckoo

(*Coccyzus americanus*), which are summer residents; and the American robin (*Turdus migratorius*) and ruby-crowned kinglet (*Regulus calendula*), which are winter residents. Field-forest community birds also include year-round, winter and summer residents. Examples include: the mourning dove (*Zenaida macroura*) and red-winged blackbird (*Agelaius phoeniceus*), which are year-round residents; the orchard oriole (Icterus spurius) and northern rough-winged swallow *(Stelgidopteryx serripennis*), which are summer residents; and the field sparrow *(Spizella pusilla*) and lark sparrow (*Chondestes grammacus*), which are winter residents (SERI 2005).

Water-Dependent Birds

Water-dependent birds observed on Hamilton and Gin Lakes include herons (for example, great blue heron [*Ardea herodias*], tricolored [Louisiana] heron [*Egretta tricolor*]), egrets (such as the cattle egret *[Bubulcus ibis]* and great [common] egret [*Ardea alba*]), ibis (such as the white ibis [*Eudocimus albus*]), wood stork or wood ibis (*Mycteria americana*), belted kingfisher (*Ceryle alcyon*), American coot (*Fulica americana*), pied-billed grebe (*Podilymbus podiceps*), and several waterfowl species (for example, the mallard [*Anas platyrhynchos*], northern pintail [*Anas acuta*], wood duck [*Aix sponsa*]). Use of the lakes by water-dependent species is seasonal. Of the water birds, only the wood duck, great blue heron, and belted kingfisher are permanent residents. According to the environmental report, the remaining species are primarily summer residents, with the exception of the American coot and pied-billed grebe, which occur in the area from fall through early spring (SERI 2005).

Birds of Prey

Birds of prey observed on or near the Grand Gulf site include vultures (such as, the black vulture [*Coragyps atratus*] and turkey vulture [*Cathartes aura*]), hawks (for example the broad-winged hawk [*Buteo platypterus*], northern harrier [*Circus cyaneus*], red-shouldered hawk [*Buteo lineatus*], red-tailed hawk [*Buteo jamaicensis*], sharp-shinned hawk [*Accipiter striatus*]), falcons (such as the American kestrel [*Falco sparverius*]), kites (such as the Mississippi kite [*Ictinia mississippiensis*]), and owls (for example, the great horned owl [*Bubo virginianus*], and eastern screech-owl [*Otus asio*]). Black and turkey vultures, the red-tailed and red-shouldered hawks, and all the owl species are year-round residents. The broad-winged hawk and Mississippi kite are summer residents, and the northern harrier, American kestrel, and sharp-shinned hawk occur on site only during migration. With the exception of the northern harrier (an inhabitant of grasslands and marshes), woodlands and wooded margins are the preferred habitat for the birds of prey observed (SERI 2005).

Upland Game Birds

Of the upland game birds observed on or near the Grand Gulf site, the mourning dove, northern bobwhite (*Colinus virginianus*), and wild turkey (*Meleagris gallopavo*) are year-round residents. The mourning dove is also the most abundant of the upland game birds onsite (SERI 2005).

All the bird species noted above are considered common, with the exception of the wood stork and Louisiana heron (SERI 2005).

Wildlife along the Grand Gulf Nuclear Station Unit 1 Transmission Line Rights-of-Way

SERI did not indicate wildlife or habitat within the GGNS Unit 1 transmission line rights-of-way (Baxter-Wilson and Franklin lines) in its environmental report (SERI 2005, 2004d). Further, no such information is available from the transmission and distribution system owner and operator, Entergy Mississippi, Inc. (Entergy Services 2004a).

State-Listed Species

State-listed threatened and endangered terrestrial species that may occur in the vicinity of the Grand Gulf site are listed in Table 2-6. Location information for State-listed species within 3.2 km (2 mi) and 16 km (10 mi) of the Grand Gulf site was obtained from the Mississippi Natural Heritage Program (MNHP) (MNHP 2004a, 2004b).

Animal Species

Two State-listed endangered terrestrial animal species are known to occur on and in the near vicinity (<3.2 km (2 mi)) of the Grand Gulf site: the Louisiana black bear (*Ursus americanus luteolus*) and wood stork (*Mycteria americana*) (Table 2-6). One State-listed endangered bird species has been reported to occur within 16 km (10 mi) of the Grand Gulf site: the least tern (*Sterna antillarum*) (Table 2-6). Two other State-listed endangered species have been reported beyond 16 km (10 mi) of the Grand Gulf site: the bald eagle (*Haliaeetus leucocephalus*) and Florida panther (*Puma concolor coryi*) (Table 2-6). The Florida panther, bald eagle, least tern, and Louisiana black bear are also Federally listed species and are described in Section 2.7.1.2. The wood stork is discussed below.

The wood stork is a highly colonial species, usually nesting and feeding in flocks. The wood stork has been occasionally sighted in all states east of the Mississippi River, and sporadically sighted in some states west of the Mississippi River (FWS 1996). Breeding populations of the wood stork are Federally listed as endangered and currently occur or have recently occurred only in Alabama, Florida, Georgia, and South Carolina (49 FR 7332; FWS 1996). Thus, the above breeding populations are not considered in this EIS.

Table 2-6. State-Listed Terrestrial Species Occurring on and in the Vicinity of the Grand Gulf Site

Scientific Name	*Common Name*	*Status*[(a)]	*Distance from the Grand Gulf Site*[(b)]	*Source*[(b)]
Mammals				
Puma concolor coryi	*Florida panther*	*SE*	*>16 km (10 mi)*	*MNHP 2004b*
Ursus americanus luteolus	*Louisiana black bear*	*SE*	*onsite and <3.2 km (2 mi)*	*NRC 1981; MNHP 2004a; SERI 2005*
Birds				
Haliaeetus leucocephalus	*bald eagle*	*ST*	*>16 km (10 mi)*	*MNHP 2004b*
Mycteria americana	*wood stork*	*SE*	*onsite and <3.2 km (2 mi)*	*AEC 1973; MNHP 2004a*
Sterna antillarum	*least tern*	*SE*	*<16 km (10 mi)*	*MNHP 2004b*
Plants				
Mimulus ringens	*Allegheny monkeyflower*	*S1-S2*	*18 km (11 mi)*	*SERI 2005*
Celastrus scandens	*American bittersweet*	*S2-S3*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*
Diplazium pycnocarpon	*glade fern*	*S2-S3*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*
Marsilea vestita	*hairy waterclover*	*S1*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*
Platythelys querceticola	*jug orchid*	*S1?*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*

(a) State status rankings developed by the MNHP; for animals SE = State endangered and ST = State threatened; for plants S1 = critically imperiled, S2 = imperiled, and S3 = rare (MNHP 2004a, 2004b). Hyphenated state status ranks indicate a range in the status of the plant species based on insufficient data to make a determination. A question mark indicates uncertainty in the indicated status of the plant species.

(b) Species occurrences on the Grand Gulf site for the Louisiana black bear and wood stork are provided by SERI (2005), NRC (1981), and AEC (1973), respectively. All distances are provided by MNHP (2004a, 2004b).

It is non-breeding wood storks that are known to occur on and in the near vicinity of the Grand Gulf site (MNHP 2004a). Wood storks were observed in summer on Gin and/or Hamilton lakes during 18 years prior to construction of GGNS Unit 1 (AEC 1973). The wood stork should currently be considered a possible non-breeding transient to the Grand Gulf site and vicinity (SERI 2005; MNHP 2004a).

Plant Species

Four State-listed critically imperiled (endangered) or imperiled (threatened) plant species were identified through correspondence with the MNHP (2004a, 2004b). The two critically imperiled plant species are hairy waterclover (*Marsilea vestita*) and jug orchid (*Platythelys querceticola*). The two imperiled plant species are glade fern (*Diplazium pycnocarpon*) and American bittersweet (*Celastrus scandens*). All four species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Grand Gulf site (MNHP 2004a, 2004b). One State-listed critically imperiled/imperiled plant species, the Allegheny monkeyflower (*Mimulus ringens*), was mentioned in SERI's environmental report (SERI 2005). The occurrence of the species nearest to the Grand Gulf site is about 11 miles to the southwest along the west bank of the Mississippi River northeast of St. Joseph, Louisiana (SERI 2005). None of the species have been reported on the Grand Gulf site.

Hairy waterclover grows in creekbeds, wetlands, seasonal pools, ditches, flood basins, and on the shores of lakes and streams, and is adapted to fluctuating water levels (WSDOE 2004). In the southeast region of the United States, hairy waterclover is considered an obligate wetland plant, which occurs almost always under natural conditions in wetlands, per the Regional Interagency Review Panel Revision of the National List of Plant Species that Occur in Wetlands (NRCS 2004).

The jug orchid grows in the humus of swamps, hardwood forests, and hammocks (Garay 1977). In the southeast region of the United States, the jug orchid is considered a facultative wetland plant that usually occurs in wetlands, but occasionally is found in non-wetlands (NRCS 2004; USDA 2004c).

The glade fern grows in moist open woods, moist meadows, and swamps (Connecticut Botanical Society 2004). In the southeast region of the United States, the glade fern is considered a facultative plant that is equally likely to occur in wetlands or non-wetlands (NRCS 2004; USDA 2004c).

American bittersweet grows along roadsides, fence rows, and forest margins. In the southeast region of the United States, insufficient information is available to determine the status of this species as a wetland indicator (NRCS 2004; Oklahoma Biological Survey 2004; USDA 2004c).

The square-stemmed monkeyflower's preferred habitat consists of wet meadows, stream banks, and damp ditches (SERI 2005).

2.7.1.2 Threatened and Endangered Terrestrial Species

This section describes Federally listed and proposed threatened and endangered terrestrial species and designated and proposed critical habitats that may occur on or in the vicinity of the Grand Gulf site and transmission line rights-of-way (Table 2-7). Information on Federally listed species in Claiborne County was obtained through correspondence with the U.S. Fish and Wildlife Service (FWS) (FWS 2004a, 2004b). In addition, a list of Federally listed species occurring in counties other than Claiborne (Franklin, Jefferson, Lincoln, Warren) that are crossed by the two transmission line rights-of-way (Baxter-Wilson and Franklin) was obtained from FWS county listings of such species for the state of Mississippi (FWS 2000). Location information for Federally listed species within 3.2 km (2 mi) and 16 km (10 mi) of the Grand Gulf site was obtained from the MNHP (2004a, 2004b).

Table 2-7. Federally Listed Terrestrial Species by County of Occurrence and Distance from the Grand Gulf Site

Scientific Name	Common Name	Status[a]	County	Distance from the Grand Gulf Site[b]	Source[b]
Mammals					
Puma concolor coryi	Florida panther	FE	Claiborne	>16 km (10 mi)	SERI 2005
Ursus americanus luteolus	Louisiana black bear	FT	Claiborne, Franklin, Jefferson, Warren	onsite and <3.2 km (2 mi)	FWS 2000, FWS 2004a; NRC 1981; SERI 2005
Birds					
Haliaeetus leucocephalus	bald eagle	FT	Claiborne, Warren	>16 km (10 mi)	FWS 2000, FWS 2004a
Picoides borealis	red-cockaded woodpecker	FE	Franklin	>16 km (10 mi)	FWS 2000
Sterna antillarum	least tern	FE	Claiborne, Warren	<16 km (10 mi)	FWS 2000, FWS 2004a
Reptiles					
Alligator mississippiensis	American alligator	FT (S/A)	Claiborne	onsite and <3.2 km (2 mi)	SERI 2005

(a) Federal status rankings developed by the FWS under the Endangered Species Act (1973), FE = Federal endangered, FT = Federal threatened, FT (S/A) = Federal threatened by similarity of appearance (FWS 2004a).
(b) Species occurrences on the Grand Gulf site for the Louisiana black bear provided by SERI 2005 and NRC 1981. All distances provided by MNHP (2004a, 2004b).

Federally Listed Terrestrial Animal Species

Six Federally listed threatened or endangered terrestrial animal species may occur on or in the vicinity of the Grand Gulf site and transmission line rights-of-way. These include the

- Florida panther (*Puma concolor coryi*) (SERI 2005; MNHP 2004a, 2004b, 2004c)
- American alligator (*Alligator mississippiensis*) (SERI 2005; MNHP 2004a, 2004b), which is threatened based on similarity of appearance to the American crocodile (*Crocodylus acutus*) (52 FR 21059)
- Least tern (*Sterna antillarum*) (SERI 2005; FWS 2000, 2004a) for the interior population only (FWS 1990b)
- Red-cockaded woodpecker (*Picoides borealis*) (FWS 2000)
- Bald eagle (*Haliaeetus leucocephalus*) (NRC 1981; SERI 2005; FWS 2000, 2004a), which is threatened but currently proposed for delisting (64 FR 36454)
- Louisiana black bear (*Ursus americanus luteolus*) (SERI 2005; FWS 2000, 2004a; MNHP 2004a, 2004b).

Two of these species, the American alligator (SERI 2005) and Louisiana black bear (NRC 1981; SERI 2005), are known to occur on the Grand Gulf site. Other than for the bald eagle, no known activities by the Federal government that would change the list of species or add critical habitats to the list are currently under way (SERI 2005; MNHP 2004a, 2004b; FWS 2000, 2004a).

Florida Panther

The historic range of the Florida panther was from Louisiana north and east to Tennessee and east to the Atlantic Ocean through most of the southeastern United States. Today only about 70 adult panthers remain in national and state parks and nearby private lands in southwest Florida (Florida Fish and Wildlife Conservation Commission 2004). The species is considered extirpated from the state of Mississippi.

The FWS has commented in the past on numerous sightings of the Florida panther “throughout its historic range,” while stating that no viable populations of the Florida panther now occur outside of Florida (SERI 2005). The MNHP has reported at least one sighting of the Florida panther within 3.2 km (2 mi) of the Grand Gulf site (MNHP 2004c). However, these sightings are from 1973 (MNHP 2004a) and are likely spurious because a viable population of Florida panthers has not been known in the state of Mississippi since the late 1800s (MNHP 2004d).

Further, NRC requested that FWS provide information on Federally listed species that could occur on or in the vicinity of the Grand Gulf site (NRC 2004b). The FWS response (FWS 2004a) did not include the Florida panther, indicating that it does not consider the species a possible resident in the area.

American Alligator

In 1967, the American alligator was classified as Federally endangered throughout its range, including Mississippi. By 1987, following several reclassification actions in other states, it was reclassified to "threatened based on similarity of appearance" to the American crocodile in the remainder of its range, including Mississippi (52 FR 21059). The alligator is no longer biologically imperiled in Mississippi. Its populations are considered disjunct, limited to available habitat, but stable. The declassification helps prevent excessive take of the alligator and protects the American crocodile (52 FR 21059).

During reconnaissance visits to the Grand Gulf site made by Enercon in August and October-November 2002, two alligators were observed, one in a small pond immediately adjacent to the waste water treatment facility on the site of GGNS Unit 1 and the other in the flooded borrow pit (SERI 2005). Thus, alligators appear to be relatively common onsite. Because they pose a nuisance and safety hazard to site personnel, Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) personnel occasionally capture and relocate large alligators from the Grand Gulf site (SERI 2005).

Bald Eagle

The bald eagle is a bird of aquatic ecosystems, frequenting major rivers, large lakes, reservoirs, estuaries, and some seacoast habitats. Fish are the major component of its diet, but waterfowl, seagulls, and carrion are also eaten. Bald eagles usually nest in large trees along shorelines in relatively remote areas that are free of disturbance (64 FR 36454). No critical habitat has been designated for this species (FWS 2004a).

The bald eagle is known from Claiborne County (FWS 2000, 2004a) and Warren County (FWS 2000) (Table 2-7). In the region around the Grand Gulf site, nest sites are usually in dominant living pine (*Pinus* spp.) or bald cypress trees (*Taxodium distichum*), and nesting activity usually occurs between September and January (FWS 2004a). Although a survey of the river shoreline at the Grand Gulf site has not been conducted, it appears to lack such trees. Bald eagles have been known to frequent Yucatan Lake, located across the Mississippi River west of the site (AEC 1973). However, there are currently no known bald eagle sightings within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b). Consequently, nesting on the Grand Gulf site appears possible, though unlikely because of the apparent absence of suitable mature pine or cypress trees in the bottomland adjacent to the river. Bald eagle presence on the Grand Gulf site during the nesting season should be considered possible in the absence of an aerial or ground survey to confirm or deny the presence of nest trees.

The only bald eagle nest site currently known from Warren County is at Halpine Lake, which is located along the Mississippi River north of Vicksburg about 40 km (25 mi) from the Grand Gulf site. There are no other bald eagle nest sites, and no roost sites or feeding concentrations, currently known from Warren County. Bald eagle locations are obtained on a volunteer basis in Mississippi because there is no funded monitoring program. Most known locations have been reported by sportsmen (fishermen and hunters). Thus, it is possible that eagles use the Mississippi River corridor elsewhere in Warren County for nesting, roosting, and/or foraging, but that such occurrences have not been reported to the State (MMNS 2005).

Interior Least Tern

Interior least terns breed in the Mississippi and Rio Grande River Basins, from Montana to Texas, and from eastern New Mexico and Colorado to Indiana and Louisiana. From late April to August, they nest primarily on barren to sparsely vegetated sand and gravel riverine sandbars, dike field sandbar islands, sand and gravel pits, and shorelines of lakes and reservoirs. Interior least terns are colonial nesters with nests from a few meters to hundreds of meters apart. The wintering area of interior least terns is unknown (FWS 1990b).

Threats include the actual and functional loss of riverine sandbar habitat. Sandbars are not generally stable features of the natural river landscape, but are formed or enlarged, disappear or migrate depending on the dynamic forces of the river. River stabilization to achieve objectives for navigation, hydropower, irrigation, and flood control has destroyed the dynamic nature of these processes. Many remaining sandbars are unsuitable for nesting because of vegetation encroachment or are too low and subject to frequent inundation. Recreational use of sandbars during the breeding season has also contributed to the decline of the species (FWS 1990b).

On the Mississippi River, least terns use sandbars for nesting, foraging (primarily on shad [*Dorosoma* spp.]), and loafing when the river has receded and sandbars are exposed. On the Mississippi River, surveys for interior least terns have been conducted since 1986 over about 909 km (565 mi) from Cape Girardeau, Missouri (River Mile (RM) 1000) to Vicksburg, Mississippi (RM 435). The first intensive survey south of Vicksburg was conducted on July 2004 (ACE 2004a). The nearest areas occupied by terns upstream and downstream of the Grand Gulf site (RM 405) (SERI 2005) were

- Yucatan Dikes (RM 409.8), loafing area for 28 birds on the Mississippi side of the river
- Togo Island Dikes (RM 413.6), nesting colony of 395 birds on the Louisiana side of the river

- Below Bondurant Towhead Dikes (RM 393.0), nesting colony of 59 birds on the Louisiana side of the river (ACE 2004b).

Sandbars develop on the inside bends of the Mississippi River where currents are slower. Sandbars do not develop on the outside bend of the river where currents are swifter and where the river shoreline has been revetted (rip-rap emplaced) to prevent erosion, such as is the case at the Grand Gulf site. The nearest potential tern nesting habitat is near RM 402 on the Louisiana side of the Mississippi River about 4.8 km (3 mi) south of the Grand Gulf site (ACE 2004a).

The point along the Baxter-Wilson transmission line right-of-way within Warren County that is closest to the Mississippi River is at its terminus at the Baxter-Wilson Substation (RM 433.1), located 0.74 km (0.46 mi) from the river. The nearest areas occupied by terns downstream and upstream of the Baxter-Wilson Substation were at Below Racetrack Dikes (RM 429.0) (nesting colony of 91 adults on the Mississippi side of the river) and at Milliken Bend (RM 456.0) (one adult tern observed on the Louisiana side of the river) (ACE 2004b). Both locations are at least 6.4 km (4 mi) from the Baxter-Wilson Substation. Between Togo Island Dikes (RM 413.6) and Below Racetrack Dikes are two other areas occupied by terns, Newton Bend Dikes (RM 419.5, nesting colony of 14 birds on the Mississippi side of the river) and Across from Logo Landing (RM 418.3, nesting colony of 58 birds on the Louisiana side of the river) (ACE 2004b). It is estimated that these two tern nesting areas are approximately 3.2 km (2 mi) from the Baxter-Wilson transmission line right-of-way.

Red-Cockaded Woodpecker

The red-cockaded woodpecker is endemic to open, mature, and old growth pine ecosystems in the southeastern United States. Red-cockaded woodpeckers are a cooperatively breeding species, living in family groups that typically consist of a breeding pair with or without one or two male helpers. In red-cockaded woodpeckers (and other cooperative breeders), a large pool of helpers is available to replace breeders when they die. Helpers do not disperse very far and typically occupy vacancies on their natal territory or a neighboring one (FWS 2003).

Red-cockaded woodpeckers require open pine woodlands and savannahs with large old pines for nesting and roosting habitat (clusters). Large old pines are required as cavity trees because the cavities are excavated completely within inactive heartwood and because of the higher incidence of heartwood decay that greatly facilitates excavation. Cavity trees must be in open stands with little or no hardwood midstory and few or no overstory hardwoods. Suitable foraging habitat consists of mature pines with an open canopy, low densities of small pines, little or no hardwood or pine midstory, few or no overstory hardwoods, and abundant native bunchgrass and forb groundcovers (FWS 2003).

Limiting factors are those that directly affect the number of potential breeding groups because this is the primary determinant of population size. For example, if groups are isolated in space, dispersal of helpers to neighboring territories is disrupted, promoting failure to replace breeders, rendering populations much less likely to persist through time. Thus, habitat fragmentation may directly limit the number of potential breeding groups. Fire suppression, which promotes hardwood encroachment, and lack of cavity trees also limit the number of breeding groups in most populations. Red-cockaded woodpeckers cannot tolerate hardwood encroachment and colonization of unoccupied habitat is an exceedingly slow process because cavities take long periods of time to excavate and birds do not occupy habitat without cavities (FWS 2003).

Of the counties containing the Grand Gulf ESP facility and transmission line rights-of-way (Claiborne, Franklin, Jefferson, Lincoln, Warren), the species is not known, either historically or currently, from Claiborne and Warren counties (Costa and Walker 1995). In Mississippi, the red-cockaded woodpecker is currently known from Bienville, DeSoto, and Homochitto National Forests, and Noxubee National Wildlife Refuge (FWS 2003). All these, except Homochitto National Forest, are located at least 160 km (100 mi) east of the Grand Gulf site. The other three counties (Franklin, Jefferson, Lincoln) traversed by the Grand Gulf ESP transmission line rights-of-way are crossed by the Homochitto National Forest.

The red-cockaded woodpecker is known to have occurred historically in Franklin, Jefferson, and Lincoln counties (Costa and Walker 1995). The FWS (2000) does not list the species as currently existing in Jefferson and Lincoln counties (Table 2-7). Six historic (inactive) red-cockaded woodpecker clusters (colonies) are located within 3.2 km (2 mi) of the Franklin transmission line right-of-way where it crosses the Homochitto National Forest in Franklin and Lincoln counties (USFS 2005a). Of the six, the closest to the Franklin line right-of-way is about 1.2 km (0.75 mi) (USFS 2005a). The U.S. Forest Service is required to maintain foraging habitat in areas of historic clusters located outside Habitat Management Areas (HMAs) designated for the recovery of the species (see below) (USFS 2005b). Historic clusters have not been identified within the Homochitto National Forest in Jefferson County (USFS 2005a).

The red-cockaded woodpecker is also known to currently occur in Franklin County (Table 2-7) (Costa and Walker 1995; FWS 2000). In Franklin County, a red-cockaded woodpecker HMA is situated within the Homochitto National Forest south and west of the intersection of State highways 84 and 98 at Meadville (USFS 2005a). The HMA is located approximately 16 km (10 mi) to the southwest of the Franklin transmission line right-of-way (USFS 2005a). This HMA consists of 19,400 ha (48,000 ac) that support 65 active red-cockaded woodpecker clusters. The HMA also contains enough currently unoccupied habitat that serves as the recruitment area for expansion of the 65 clusters to 250 clusters (USFS 2005c), the recovery plan goal for the species on the Homochitto National Forest (FWS 2003). These clusters have been designated a secondary core population (providing for conservation of the species within the physiographic recovery unit in which it exists) within the East Gulf Coastal Plain Recovery Unit of the species. The projected time required for the Homochitto population to reach recovery size is 35 years (FWS 2003).

In addition, there are forest management activities (e.g., prescribed burning and thinning) underway to restore old-age longleaf pine (*Pinus palustris*) stands across the Homochitto National Forest (USFS 2005c). The target species for these management activities is the red-cockaded woodpecker (USFS 2005c), although such activities outside the HMA discussed above are not officially part of the recovery plan for the species (FWS 2003; USFS 2005c). Thus, in the future red-cockaded woodpeckers could inhabit restored old-age longleaf pine areas outside the HMA (USFS 2005c).

Louisiana Black Bear

The historic range of the Louisiana black bear (*Ursus americanus luteolus*) included southern Mississippi (south of and including Washington, Humphreys, Holmes, Attala, Neshoba, and Lauderdale counties), all of Louisiana, and eastern Texas. Two subspecies of black bear historically occupied Mississippi, the Louisiana black bear in the south and the American black bear (*U. a. americanus*) in the north. Because the two subspecies are indistinguishable by sight, other free-living bears of the species *U. americanus* within the historic range of *U. a. luteolus* are designated Federally threatened by similarity of appearance (FWS 1995).

The historic habitat of the Louisiana black bear has suffered extensive modification, having been reduced by more than 80 percent as of 1980. The remaining habitat has been reduced in quality by fragmentation and conversion to agriculture. Habitat destruction or modification is the primary threat to the Louisiana black bear. Human-related mortality also continues to pose a threat to the subspecies (FWS 1995).

The key habitat requirements of black bears are food, water, cover, and den sites that are spatially arranged across sufficiently large, relatively remote blocks of land. Remoteness is relative to forest tract size and the presence of roads. Examples of remoteness relative to black bears include a tract of timberland 0.8 km (0.5 mi) from well maintained roads and development, a forested tract of more than 1000 ha (2500 ac), or a tract with 0.5 km (0.3 mi) or less of road per km^2 (0.4 mi^2) of forest (FWS 1995). A geographic information system analysis has not been conducted, but it is evident from Figure 2-4 that much of the Grand Gulf site and immediate environs to the north and south closely approach or satisfy one or more of these criteria.

Louisiana black bears typically inhabit heavily wooded bottomland hardwoods and swamps, although adjacent upland habitat types are also used (LDOTD 2003). Occupied Louisiana black bear habitat has been defined by the FWS (1995) as only those areas where there is evidence of reproduction, such as a female with cubs. Presently within the historic range of the

Louisiana black bear, two known breeding bear populations occur in two Louisiana river basins (Figure 2-6). One range is the Tensas River Basin, consisting of Franklin, Madison, and Tensas parishes. The Tensas River Basin is located in rural northeastern Louisiana and contains an estimated 160 bears (Beausoleil 1999; Boersen 2001). Tensas Parish is located directly across the Mississippi River from Claiborne County and the Grand Gulf site. The other range is the Atchaflaya River Basin, located in south-central Louisiana and divided into two units: upper, and lower/coastal. The upper and coastal units support subpopulations of 52 and 92 bears, respectively (Triant 2001).

Bears have been sighted outside of the two areas, but it is unknown whether these bears are reproducing or are only wandering subadults and males. Additional areas possibly occupied are the Mississippi River corridor, including portions of the Loess Bluffs in southwestern Mississippi and the adjacent Tunica Hills of Louisiana (about 120 km (75 mi) south of the Grand Gulf site), and smaller areas in the lower East Pearl River and lower Pascagoula River basins of southern Mississippi near the Gulf of Mexico (FWS 1995).

Figure 2-6. Louisiana Black Bear Breeding Subpopulations (U.S. Fish and Wildlife Service, Jackson, Mississippi Field Office)

The FWS, Louisiana Department of Wildlife and Fisheries, and the Black Bear Conservation Committee began reintroducing Louisiana black bears into unoccupied habitat on publicly owned land in the Red River/Three Rivers area of east-central Louisiana in March 2001 (FWS 2004d). The northern boundary of the repatriation area is located about 88 km (55 mi) southwest of the Grand Gulf site. To date, 16 adult females and 40 cubs have been reintroduced. These bears have dispersed throughout the repatriation area and beyond (FWS 2004d). Some have dispersed as far north as Vidalia, Louisiana (FWS 2004d), located just across the Mississippi River from Natchez, Mississippi, about 56 km (35 mi) southwest of the Grand Gulf site.

Many bears have been sighted in the Mississippi River corridor within the last 8 years (Figure 2-7) (MNHP 2004e). The Louisiana black bear may use the Mississippi River environs as a travel corridor (SERI 2004d) between the Tensas River Basin and upper Atchaflaya River Basin, and it could thus serve as an important link between the two.

The MNHP has reported bear occurrences within 3.2 km (2 mi) of the Grand Gulf site (MNHP 2004a), and bears have been observed on the Grand Gulf site (NRC 1981). Two bear cubs were reported onsite by a hunter in 1978. Afterward, bear tracks were observed on two occasions and one adult and one young bear were seen at separate times by the biologist onsite (NRC 1981). However, the occurrence of bears onsite has not been documented recently (SERI 2004d). Because the two subspecies (*Ursus a. luteolus* and *U. a. americanus*) are indistinguishable by sight, one must conservatively assume that all the sightings noted above were of the Louisiana black bear. Further, suitable den sites in fallen trees have also been reported from onsite (SERI 2004d), although it is unknown if these trees satisfy the species, size, and location criteria specified in 57 FR 588.

The Grand Gulf site provides large tracts of bottomland and upland hardwood forests that are contiguous with other relatively large, adjacent expanses of hardwood forest. These are suitable for bears because they are relatively remote by the above standards and subject to relatively little human disturbance, particularly those on the Grand Gulf site, because of public access restrictions. Public access restrictions may protect bears from illegal hunting and collisions with cars because of the low traffic volume on roads in and around the site. Black bears are generally highly adaptable and tend to survive in a variety of situations where they are protected from over-harvesting and other negative interactions with humans. Because bears coexist readily with humans when provided areas in which they can avoid contact, the possibility that Louisiana black bears still inhabit the Grand Gulf site is high (SERI 2005).

Some Louisiana black bear sightings from the last 8 years (Figure 2-7) were in counties other than Claiborne (Franklin, Jefferson, Warren) that are crossed by the transmission line rights-of-way (Baxter-Wilson and Franklin). The subspecies is known to occur only in the western most portion of Franklin County where hardwood forests are more prevalent (USFS 2005d). The subspecies is also known to occur only in the western most portion of Jefferson County near

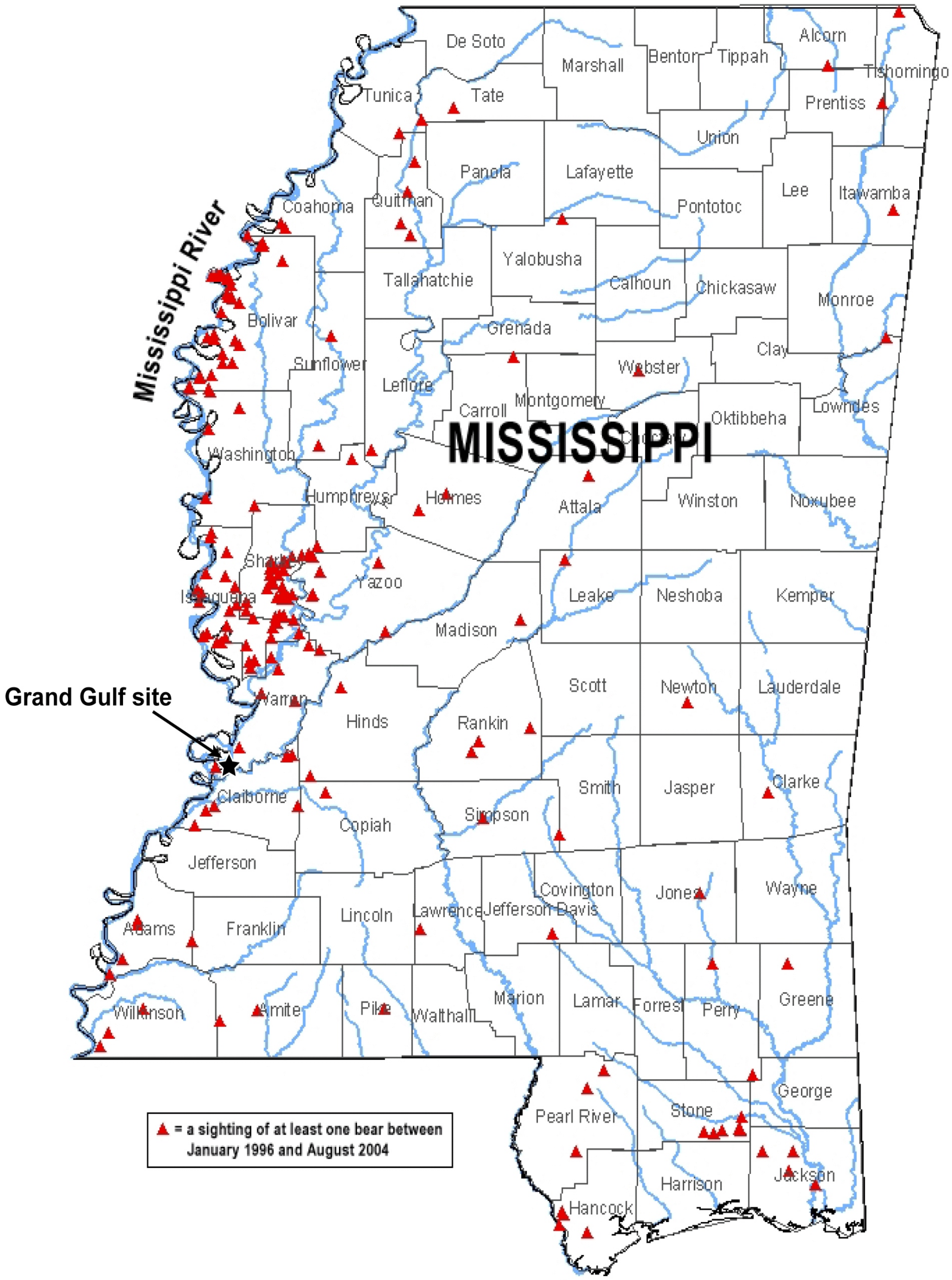

Figure 2-7. Black Bear Sightings from the State of Mississippi from 1996 to 2004 (U.S. Fish and Wildlife Service, Jackson, Mississippi Field Office)

the Mississippi River (USFS 2005d). The Franklin transmission line right-of-way traverses the northeastern portions of Franklin and Jefferson counties and is thus at least 32 km (20 mi) distant from the nearest sighting of the Louisiana black bear in these counties. However, the subspecies is known to occur along the Mississippi River in Warren County (Figure 2-7) in the general area crossed by the Baxter-Wilson transmission line right-of-way.

Three critical habitat areas totaling about 505,900 ha (1.25 million ac) have been proposed for the Louisiana black bear (58 FR 63560): Tensas River Basin, Atchaflaya River Basin Floodway, and lower Iberia-St. Mary Parish. The proposed critical habitat area nearest the Grand Gulf site is the Tensas River Basin, which borders the west bank of the Mississippi River directly across from the site.

Because of their importance, actual den sites or candidate trees (bald cypress and tupelo gum [*Nyssa* sp.] with visible cavities, having a diameter at breast height of 0.9 m (3 ft) and occurring along rivers, lakes, streams, bayous, sloughs, or other water bodies) in occupied habitat may not be harvested (57 FR 588). However, this may not affect the Grand Gulf ESP site because it is currently unknown whether habitat in this area is occupied and whether bald cypress and/or tupelo gum trees of this stature exist onsite.

Federally Listed Terrestrial Plant Species

No Federally listed or proposed threatened or endangered terrestrial plant species or associated designated or proposed critical habitat were identified through consultation with the FWS as potentially occurring on or in the vicinity of the Grand Gulf site (FWS 2004a).

2.7.1.3 Terrestrial Ecology Monitoring

Formal terrestrial ecological monitoring has not been conducted on the Grand Gulf site since construction of GGNS Unit 1. However, reconnaissance visits to the site were made by Enercon on behalf of SERI during the weeks of August 19 to 24 and October 29 to November 1, 2002 (SERI 2005). The purpose of these visits was to describe the wetlands and qualitatively compare existing ecological resources with descriptions provided in the MP&L final environmental report (1973). Information provided in the MP&L final environmental report was based on formal terrestrial ecological monitoring conducted from June 1972 to August 1973 prior to construction of the GGNS Unit 1 facility (SERI 2005).

Descriptions of the various types of wetlands found on the Grand Gulf site based on these reconnaissance visits are provided in Section 2.7.1. There apparently have been no noteworthy environmental alterations on the Grand Gulf site since construction of GGNS Unit 1 that contribute significantly to the existing patterns of plant and animal communities described in Section 2.7.1.

Terrestrial ecological monitoring may be performed in support of an application for an ESP. Monitoring primarily consists of collecting data used to describe the distribution and abundance of important species and habitats and environmental changes that may contribute to the existing patterns of plant and animal communities (NRC 2000).

As noted above, based on Enercon's 2002 reconnaissance visits (SERI 2005), the vast majority of the Grand Gulf site has been left undisturbed since construction of GGNS Unit 1. Thus, no monitoring of environmental changes that contribute to existing patterns of plant and animal communities is needed.

Wetlands are considered an important habitat (NRC 2000). Besides wetlands, no other important habitats are known to occur on the Grand Gulf site or along its transmission line rights-of-way. Wetlands on the Grand Gulf site would be minimally affected by construction (see Section 4.4.1) and then restored.

The only Federally listed species known to inhabit the Grand Gulf site is the Federally threatened American alligator. However, the alligator is threatened only because of its similarity of appearance to the American crocodile. Thus, the threatened classification of the alligator helps protect the crocodile. American alligator populations are themselves considered disjunct, limited to available habitat, but stable (52 FR 21059).

The Federally threatened Louisiana black bear is known to occur within 3.2 km (2 mi) (MNHP 2004a) of the Grand Gulf site and was documented from the site in the late 1970s (NRC 1981). Because the site and its immediate environs to the north and south provide a large block of remote habitat with relatively little human presence, it is very likely Louisiana black bears still exist onsite. However, its occurrence onsite has not been documented recently, and no monitoring via field surveys or other methods has been conducted on the Grand Gulf site or in the near vicinity.

Use of the Grand Gulf ESP site and adjacent areas in upland hardwood forest and bottomland forested wetlands by Louisiana black bears should be established via field surveys prior to construction of a new facility at the Grand Gulf site. The Louisiana black bear could be affected by construction if present in these areas. Consequently, a plan for pre-construction monitoring of use of the Grand Gulf ESP site and near vicinity by the Louisiana black bear should be established in consultation with the FWS, Jackson, Mississippi, Field Office.

2.7.2 Aquatic Ecology

The aquatic resources in the vicinity of the proposed Grand Gulf ESP site are associated with the major aquatic features of the Grand Gulf site: the Mississippi River and two onsite oxbow lakes, Hamilton and Gin (Figures 2-1 and 2-2). Also associated with the Grand Gulf site are a flooded, fabricated borrow pit, three small ponds, and two perennial streams. In addition, ephemeral drainages and wetlands are found around the site. The Grand Gulf site does not front on the Big Black River to the north or on the Bayou Pierre River to the south (MP&L 1973; SERI 2005).

The habitat of the Mississippi River has the following features: backwater, river bank, and main channel. The backwater habitat is associated with the large bend in the river at the site, which creates slow moving, relatively shallow, quiet water. The substrate in the backwaters is loosely consolidated, silty clay sediment of low plasticity. The river bank habitat is steep with swift current, consolidated, high-plastic clay substrate, and eroding slopes. In 1979, the river bank downstream of the discharge structure and barge slip was stabilized with articulated concrete mats (NRC 1981). The main channel is deep with strong, turbulent currents and coarse-grained substrate (MP&L 1973; SERI 2005).

Hamilton and Gin are oxbow lakes on the Grand Gulf site. These lakes are what remain of the former river channel after the Mississippi River moved to the west. Hamilton and Gin lakes are relatively small and shallow with characteristics similar to the backwater habitat. The surface area of these lakes has decreased since 1973, and the last estimates made in 2001 indicate the surface area of Hamilton Lake is 26 ha (64 ac) and Gin Lake is 22 ha (55 ac). The average depth of these lakes is approximately 2 to 3 m (8 to 10 ft). However, during high-water events, the Mississippi River submerges these lakes. Hamilton Lake receives water from two perennial streams, which carry storm water from the existing facility. Gin Lake is connected to Hamilton Lake via a culvert beneath Heavy Haul Road (MP&L 1973; SERI 2005).

A flooded, fabricated borrow pit north of the barge slip was created in the 1970s when fill was excavated for use in the construction of GGNS Unit 1. The depth of the pit is not known. The surface area in 2001 was estimated to be 6.5 ha (16 ac) in size. The pit does not appear to be hydrologically connected to the lakes except during high water of the river (SERI 2005).

Before the development of the Grand Gulf site, the three small ponds were constructed onsite to provide water for cattle stock. At the time of construction of Unit 1, five small ponds existed, each under 0.8 ha (2 ac) in size. Since 1973, two of the ponds have been filled and no longer exist (MP&L 1973; SERI 2005).

The two perennial streams onsite are called Streams A and B. Stream A extends west from the site's sanitary waste water treatment facility. Currently, Stream A receives continual flow from facility storm water and processed discharge from the waste water treatment facility. Stream B extends west from the cooling towers on the south side of Heavy Haul Road. Flow in Stream B is intermittent, consisting mostly of storm runoff, and runs into Hamilton Lake. A sedimentation basin has been constructed on both Stream A and B, called Outfall 13 and 14, respectively (MP&L 1973; SERI 2005).

Ephemeral drainages occur on the upland bluffs and eastern portions of the Grand Gulf site. These drainages are estimated to be approximately 7358 m (24,140 ft) in length (MP&L 1973; SERI 2005).

2.7.2.1 Biological Communities

The staff evaluated the effect of construction and operation of the proposed Grand Gulf ESP facility on aquatic ecological resources (habitat and wildlife) existing at and in the vicinity of the site and along the transmission line rights-of-way. The last time the aquatic resources were extensively characterized was from September 1972 to August 1973 during the preconstruction studies for GGNS Unit 1 (MP&L 1973; SERI 2005). In 2002, two reconnaissance surveys were made to assess qualitatively the ecological resources of the Grand Gulf site. No data pertaining to aquatic resources on the site or along the transmission line rights-of-way were presented. Since the most recent information on aquatic resources summarized in the Final Environmental Report (MP&L 1973) is over 30 years old, the staff will obtain (consistent with Environmental Standard Review Plan, Chapter 2.4.2 (NRC 2000)) a recent description of the aquatic biota in the vicinity of the site and transmission line rights-of-way prior to or during the CP or COL phase.

The studies conducted prior to construction of GGNS Unit 1 characterized the aquatic resources in the Mississippi River, Hamilton and Gin lakes, two ponds, and Stream A. A total of 86 fish species were collected, representing 20 families and 42 genera (MP&L 1973; SERI 2005). The presence of other aquatic species was also reported (MP&L 1973).

Mississippi River

Preconstruction studies from 1972 to 1973 included collections of fish, benthic macroinvertebrates, and plankton. The characterization of the river was divided into several habitat types related to the flow rate and substrate: backwater, river bank, and main channel. A total of 69 fish species were caught. This was the same number of species found in the Mississippi River during the same time period at the River Bend Nuclear Station, 232 km (144 mi) downstream from GGNS. However, the fish species diversity was less than that characterized in the lower Mississippi River prior to the release of endrin (a pesticide) around Memphis in 1963 to 1964 that resulted in catastrophic fish kills (MP&L 1973).

The dominant species in the Mississippi River based on numbers and weight were gizzard shad (*Dorosoma cepedianum*), freshwater drum (*Aplodinotus grunniens*), blue catfish (*Ictalurus furcatus*), and flathead catfish (*Pylodictis olivaris*). The numbers varied within the particular habitats of the river. In the backwater habitat, the dominant species were gizzard shad, blue catfish, river carpsucker (*Carpiodes carpio*), freshwater drum, and shovelnose sturgeon (*Scaphirhynchus platorynchus*). In the river bank, the dominant fish were gizzard shad, freshwater drum, silver chub (*Macrhybopsis storeriana*), flathead catfish, and blue catfish. The main channel was not easily characterized for dominant species because collection techniques were hampered by the currents, irregular bed configurations, and bottom associated debris (MP&L 1973).

Juvenile fish increased in numbers from March through July. The results indicated that shad spawned from March through June. Drum appeared to spawn over a shorter period and may have included two spawning periods. Young-of-the-year for gizzard shad and drum were highest in June and July. Larval fish were collected in early March. While catfish and suckers were prominent as adults, they were not among the larvae collected in the river because they are spawned in backwaters and do not enter the riverine environment until they are juveniles (MP&L 1973).

Benthic macroinvertebrate populations were most common in the backwaters of the riverine environment. Dipteran larvae (aquatic true fly larvae), tube-forming worms, and bivalves (mussels and clams) represented the dominant groups of macroinvertebrates. Where the river banks were stable (consolidated silt and clay), mayflies were the most common macroinvertebrate. The 1973 report stated that macroinvertebrates were found in areas where the river bank was stable, but few or no macroinvertebrates were found where the river bank was constantly eroding (MP&L 1973). Nevertheless, in 1981, MP&L concluded that macroinvertebrates would not colonize areas where the banks were stabilized with articulated concrete mats (NRC 1981). Macroinvertebrates were also absent in the main channel of the river, probably because of strong currents and coarse sand-gravel sediment (MP&L 1973).

Drifting benthic macroinvertebrates were also collected in the river and adjacent backwaters. The majority of the drifting macroinvertebrates was composed of dipteran pupae and larvae, predominantly of the genus *Chaoborus*. A total of 96 macroinvertebrate taxa were collected in drift samples (MP&L 1973).

Another predominant invertebrate was the river shrimp (*Macrobrachium ohione*). These shrimp were caught mainly along the river banks with their numbers peaking in October and dropping from November to April, when water temperatures were coldest (MP&L 1973).

Plankton in the Mississippi River were characterized as zooplankton and phytoplankton. The density of zooplankton ranged over two orders of magnitude during the study period. A total of 46 taxa were identified, and the dominant taxa changed over time. A stalked protozoan (*Carchesium* sp.), various cladocerans, and a colonial rotifer were the dominant zooplankton. Fall and spring blooms of phytoplankton were observed. A total of 49 phytoplankton genera were identified, with centric diatoms being the most dominant (MP&L 1973).

Hamilton and Gin Lakes

Preconstruction studies from 1972 to 1973 included collections of fish, benthic macroinvertebrates, and plankton. Hamilton Lake had 46 fish species, and Gin Lake had 36 species. Several of the fish species in Hamilton and Gin lakes are thought to be from the Mississippi River. When the river floods the lakes, fish are brought into the area and then are trapped in the lakes when the flood waters recede. This relationship was demonstrated when large numbers of young-of-the-year paddlefish (*Polyodon spathula*) were observed in both lakes in July 1973, shortly after the river separated from the lakes. After another flood a month later, the number of paddlefish had decreased (MP&L 1973). The difference in fish diversity between the two lakes was attributed to the connection of Hamilton to the river during periods when the river is not at flood stage.

While more species were present in Hamilton Lake, the dominant fish were the same in both lakes. The top 80 percent of the population was made up of gizzard shad, bluegill (*Lepomis macrochirus*), threadfin shad (*Dorosoma petenense*), and largemouth bass (*Micropterus salmoides*). Several stragglers, fish that normally inhabit the river, were found in Hamilton and Gin lakes (MP&L 1973).

Benthic macroinvertebrates in Hamilton and Gin lakes more closely resembled the populations collected in the backwaters of the river. Chironomids, tubificid worms, and bivalves were the most dominant taxa (MP&L 1973).

The composition and abundance of plankton in Hamilton and Gin lakes varied based on the frequency and duration of flooding by the river. When the lakes were not flooded, they developed distinct plankton populations. However, during flood events, the populations more closely resembled those characterized in the river (MP&L 1973).

Hamilton and Gin lakes did not support vascular aquatic plants in the preconstruction studies. The only aquatic plant recorded in the lakes was the big duckweed, *Spirodela* spp. In reconnaissance visits in 2002, no emergent vegetation was found in the lakes except along the periphery (SERI 2005).

Two Ponds and Stream A

Only fish were sampled in two of the three ponds and Stream A during the GGNS preconstruction studies. The source of fish in the ponds is thought to be recruitment from either Stream A or Stream B. One of the ponds (referred to as “bluff pond 1”) contained only bluegill and mosquitofish (*Gambusia affinis*). The other pond (“bluff pond 2”) contained bluegill, mosquitofish, and a few channel catfish (*Ictalurus punctatus*) (MP&L 1973).

Stream A had 21 species, which consisted of resident fish and those that probably entered the stream during floods from the river and lakes. The dominant species included bluntnose minnow (*Pimephales notatus*), green sunfish (*Lepomis cyanellus*), longear sunfish (*Lepomis megalotis*), silvery minnow (*Hybognathus nuchalis*), and blackspotted topminnow (*Fundulus olivaceus*) (MP&L 1973).

Commercially Important Fisheries

Commercial fishing is limited in the area with most occurring on the Mississippi River near the Grand Gulf site and on the Big Black and Bayou Pierre rivers. Approximately twelve commercial fishing operations are in the area. They catch predominately catfish but also harvest bigmouth (*Ictiobus cyprinellus*) and smallmouth buffalo fish (*Ictiobus bubalus*) (SERI 2005).

Recreationally Important Fisheries

Recreational fishing occurs on the Mississippi River and Hamilton and Gin lakes. Fishing is allowed on these lakes; however, access was denied briefly in 2001 to 2002. April through September are the most popular months for sport fishing with Saturday being the busiest day of the week. On the weekends from April through September, as many as 200-250 anglers may be in the vicinity. On the weekdays, the number of anglers may drop to fewer than 150 depending on weather conditions (SERI 2005). Recreational fishing in the area is from boats and the bank as well as using trotlines in the lakes. The most common fish caught include catfish, bluegill, and bass (MP&L 1973; SERI 2005).

Nuisance Species

No reports indicate aquatic nuisance species are in the waters associated with the Grand Gulf site (MP&L 1973; NRC 1981; SERI 2005).

Aquatic Resources Associated with Transmission Line Rights-of-Way

Transmission line rights-of-way for GGNS Unit 1 cross waterways in Claiborne County. The Baxter-Wilson right-of-way crosses the Big Black River approximately 12 km (7.5 mi) to the northeast of the Grand Gulf site. Also, the Baxter-Wilson substation in Warren County is less than 0.75 km (0.47 mi) from the shores of the Mississippi River. The Franklin right-of-way crosses Bayou Pierre approximately 5.5 km (3.4 mi) to the south of the Grand Gulf site. SERI did not indicate the aquatic resources that could be associated with the waterways crossed by these transmission line rights-of-way (SERI 2005). No information on aquatic resources was available from the transmission and distribution system owner and operator (Entergy Mississippi, Inc.) (Entergy Services 2004a). SERI did not indicate the transmission line right-of-way maintenance procedures in its environmental report (SERI 2005). However, Entergy

Mississippi, Inc. indicated that the maintenance procedures consist of mechanical means (primarily bushhogging) that are performed on an as-needed basis (Energy Services 2004b).

State-Listed Species

State-listed threatened and endangered aquatic species that may occur in the vicinity of the Grand Gulf ESP site are listed in Table 2-8 (MNHP 2004a, 2004b).

Animal Species

Two State-listed endangered aquatic animal species are known to occur within 3.2 km (2 mi) of the Grand Gulf ESP site: the pallid sturgeon (*Scaphirhynchus albus*) and crystal darter (*Crystallaria asprella*) (Table 2-8). A third State-listed endangered aquatic animal species is known to occur between 3.2 km (2 mi) and 16 km (10 mi) of the Grand Gulf ESP site: the bayou darter (*Etheostoma rubrum*) (Table 2-8). The pallid sturgeon and bayou darter are also Federally listed species and are described in Section 2.7.2.2.

Table 2-8. State-Listed Aquatic Species Occurring in the Vicinity of the Grand Gulf Early Site Permit Site

Scientific Name	Common Name	Status[(a)]	Distance from the Grand Gulf ESP Site	Source
Fish				
Scaphirhynchus albus	pallid sturgeon	SE	<3.2 km (2 mi)	MNHP 2004a
Etheostoma rubrum	bayou darter	SE	<16 km (10 mi)	MNHP 2004a
Crystallaria asprella	crystal darter	SE	<3.2 km (2 mi)	MNHP 2004a

(a) State status rankings developed by the MNHP (2004a, 2004b); SE = State endangered - animals

The endangered crystal darter has a historical range throughout the Mississippi, Missouri, and Ohio rivers. The crystal darter is a large, cigar-shaped fish, which is bi-colored with the lower half being white or silvery. These fish live in swift areas of sand and gravel raceways of large rivers. Crystal darters are found in the Bayou Pierre River and tributaries, which flow as close as 3 km (1.9 mi) east of the Grand Gulf ESP site (Ross 2001; MNHP 2004b; Katula 2004).

Plant Species

No State-listed or proposed threatened or endangered aquatic plant species are known to occur on or in the vicinity of the Grand Gulf ESP site (MNHP 2004a, 2004b; SERI 2005).

2.7.2.2 Threatened and Endangered Aquatic Species

FWS and the National Oceanic and Atmospheric Administration (NOAA) Fisheries staff provided information on Federally listed species, including their presence or absence in Claiborne County and any proposed threatened and endangered aquatic species and designated and proposed critical habitats that may occur on or in the vicinity of the proposed Grand Gulf ESP site (FWS 2004a, 2004b; NMFS 2004). The location information for Federally listed species within 16 km (10 mi) of the Grand Gulf site was obtained from the MNHP (2004a, 2004b). Table 2-9 presents information on Federally listed aquatic species.

Table 2-9. Federally Listed Aquatic Species Occurring in the Vicinity of the Grand Gulf Early Site Permit Site

Scientific Name	Common Name	Status[(a)]	Distance from the Grand Gulf ESP Site	Source
Fish				
Acipenser oxyrinchus desotoi	Gulf sturgeon	FT	<16 km (10 mi)	NMFS 2004
Scaphirhynchus albus	pallid sturgeon	FE	<3.2 km (2 mi)	FWS 2004a
Etheostoma rubrum	bayou darter	FT	<16 km (10 mi)	FWS 2004a
Molluscs				
Potamilus capax	fat pocketbook mussel	FE	<16 km (10 mi)	FWS 2004b

(a) Federal status rankings developed by FWS and NOAA Fisheries under the Endangered Species Act (FWS 2004a, 2004b; NMFS 2004).
FE = Federal endangered
FT = Federal threatened

Federally Listed Aquatic Animal Species

Four Federally listed threatened or endangered aquatic animal species may occur in the vicinity of the Grand Gulf ESP site. These include the

- Gulf sturgeon (*Acipenser oxyrinchus desotoi*) (Ross 2001; NMFS 2004; SERI 2005)

- Pallid sturgeon (*Scaphirhynchus albus*) (FWS 2004a; SERI 2005)

- Bayou darter (*Etheostoma rubrum*) (FWS 2004a; SERI 2005)

- Fat pocketbook mussel (*Potamilus capax*) (FWS 2004b).

Of the Federally listed species mentioned above, only the pallid sturgeon was collected on the Grand Gulf site in the 1970s during the last effort to characterize aquatic resources. No known activities are underway by the Federal government that would change the list of species or add critical habitats to the list.

Gulf Sturgeon

The gulf sturgeon has been jointly managed and listed as a threatened species by NOAA Fisheries and FWS. Historically, the range for this anadromous sturgeon has included the lower Mississippi, where it feeds in the Gulf of Mexico and returns to freshwater for spawning. They have a sub-cylindrical body with bony plates, and their snout is greatly extended and blade like, with four fleshy barbels in front of its mouth. Their bodies are gray-brown on the back and sides, grading to white on their belly. Critical habitat has not been designated for the Gulf sturgeon in the lower Mississippi River. Gulf sturgeon have not been collected in the region of the Grand Gulf ESP site, but have been collected upstream in the region of Vicksburg. The species could be a transient or seasonal migrant (68 FR 13370; FWS MFC 1995; Ross 2001; SERI 2005; NMFS 2004).

Pallid Sturgeon

The pallid sturgeon has a range of more than 5633 km (3500 mi) through the Missouri-Mississippi River drainage, including the lower Mississippi River. The species was designated as endangered throughout its entire range in 1990. Pallid sturgeon have a long, uniformly grayish-white body, flattened, shovel-shaped snout, with a long, slender completely armored caudal peduncle, and no spiracle. They are found in the main channels of large, highly turbid, free-flowing rivers with sand flats or gravel bars. Pallid sturgeon mainly feed on other fish. Little information is available on the spawning or migration habits of the pallid sturgeon except that they are likely to spawn in the spring and summer months, similar to other North American sturgeons (55 FR 36641; FWS 1993, 2004a; Ross 2001; LDOTD 2003).

Pallid sturgeon have been collected in the region of the Grand Gulf ESP site. During the 1972 to 1973 preconstruction studies for the GGNS, a specimen was collected offshore of the site. In 2001, trawl surveys were conducted on the lower Mississippi River in the Vicksburg area, approximately 61 km (38 mi) upstream from the Grand Gulf ESP site. Several pallid sturgeon were caught in regions with moderate to strong currents, a sand or sand/gravel substrate, and areas with structure (for example, sand reefs, dunes, or secondary channel) (Ross 2001; SERI 2005; Hartfield 2003).

Bayou Darter

The threatened bayou darter is endemic to the Bayou Pierre River and tributaries, approximately 20 km (12 mi) east of the Grand Gulf site. Bayou darters are small (26 to 45 mm (1.0 to 1.8 in.)), the smallest representative of the subgenus, *Nothonotus*. The darters live in swift, shallow riffles or runs over coarse gravel and pebbles. Based on the known distribution of the bayou darter (Ross 2001), the species is likely to inhabit the waters in the vicinity of the transmission line right-of-way. Loss of habitat through erosion of the tributaries has been a concern (40 FR 44149; FWS 1990a, 2004a; Ross 2001; SERI 2005).

Fat Pocketbook Mussel

The fat pocketbook mussel was historically found throughout the Mississippi River drainage from Minnesota to Louisiana. In 1976, the fat pocketbook mussel was designated as endangered throughout its entire range. The mussel has a shiny, thin to moderately thick, rounded shell. The shell has an S-shaped hinge and is tan or light brown with no rays. Fat pocketbook mussels prefer sand, mud, and fine gravel substrate of large rivers. The greatest impact to the mussel throughout its historical range is from habitat loss and reduction in water quality. In 2003, the mussel was found near Vicksburg in the Mississippi River, as well as south of the Grand Gulf ESP site (41 FR 24062; FWS 1989, 2004b, 2004c).

Federally Listed Aquatic Plant Species

No Federally listed or proposed threatened or endangered aquatic plant, species, or associated designated or proposed critical habitat are known to occur on or in the vicinity of the Grand Gulf ESP site (FWS 2004a; SERI 2005).

2.7.2.3 Aquatic Ecology Monitoring

NRC does not impose conditions of operation related to water quality, including aquatic monitoring requirements. Regulation of water quality under the Clean Water Act (CWA 1977) is the responsibility of the U.S. Environmental Protection Agency (EPA). The EPA has delegated the NPDES permit program for the State of Mississippi to the MDEQ. NRC's role is limited to assessing aquatic impacts as part of its National Environmental Policy Act (NEPA 1969) evaluation. The use of radial collector wells for current intake of Mississippi River water for operational use has not required the assessment or monitoring of the impacts to aquatic organisms under the NPDES permit for operations at GGNS Unit 1. The last monitoring of aquatic ecology at the Grand Gulf site was part of pre-construction monitoring for GGNS Unit 1 (MP&L 1973; SERI 2005).

NRC expects SERI to work with the State to develop and implement any required monitoring programs.

2.8 Socioeconomics

The population data for the area affected by the proposed Grand Gulf ESP site are primarily based on the 2000 U.S. Census, as mapped with the LandView 5 geographic information system by SERI (SERI 2005). When economic, employment, or population trends were analyzed over time, comparisons were made between data from the 1990 U.S. Census and the 2000 U.S. Census. SERI used LandView 5 software to develop the demographic data that are used in this section of the EIS. SERI augmented the census data with information from other agencies and public organizations in the states of Mississippi and Louisiana (CPRP 2002; Irwin 1997). The area defined by an 80-km (50-mi) radius from the center of the proposed power block includes all or a portion of 25 counties and parishes in Mississippi and Louisiana. Table 2-10 identifies the counties and parishes.

Table 2-10. Counties and Parishes within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site

Mississippi Counties			Louisiana Parishes	
Adams	Issaquena	Sharkey	Caldwell	Madison
Amite	Jefferson	Simpson	Catahoula	Richland
Claiborne	Lincoln	Warren	Concordia	Tensas
Copiah	Madison	Wilkinson	East Carroll	West Carroll
Franklin	Rankin	Yazoo	Franklin	
Hinds				

Source: SERI 2005

2.8.1 Population Characteristics

Figure 2-8 shows the estimated population in 2002 within 16 km (10 mi) of the location for the Grand Gulf ESP facility. On this map, the power block for the proposed facility is located in the center with concentric circles in 1.6-km (1-mi) increments up to 8 km (5 mi) from the proposed location and then in one 8-km (5-mi) increment up to 16 km (10 mi) from the proposed location. Population data for the area surrounding the Grand Gulf ESP site indicate low population densities and a rural setting. The nearest population center is Port Gibson, Mississippi, located approximately 10 km (6 mi) to the southeast with a population of 1840 based on the 2000 U.S. Census (USCB 2003). The majority of the population in this area is African American. Four larger towns are located within 80 km (50 mi) of the Grand Gulf ESP site. Vicksburg, Mississippi, located 40 km (25 mi) to the north-northeast, had a 2000 U.S. Census

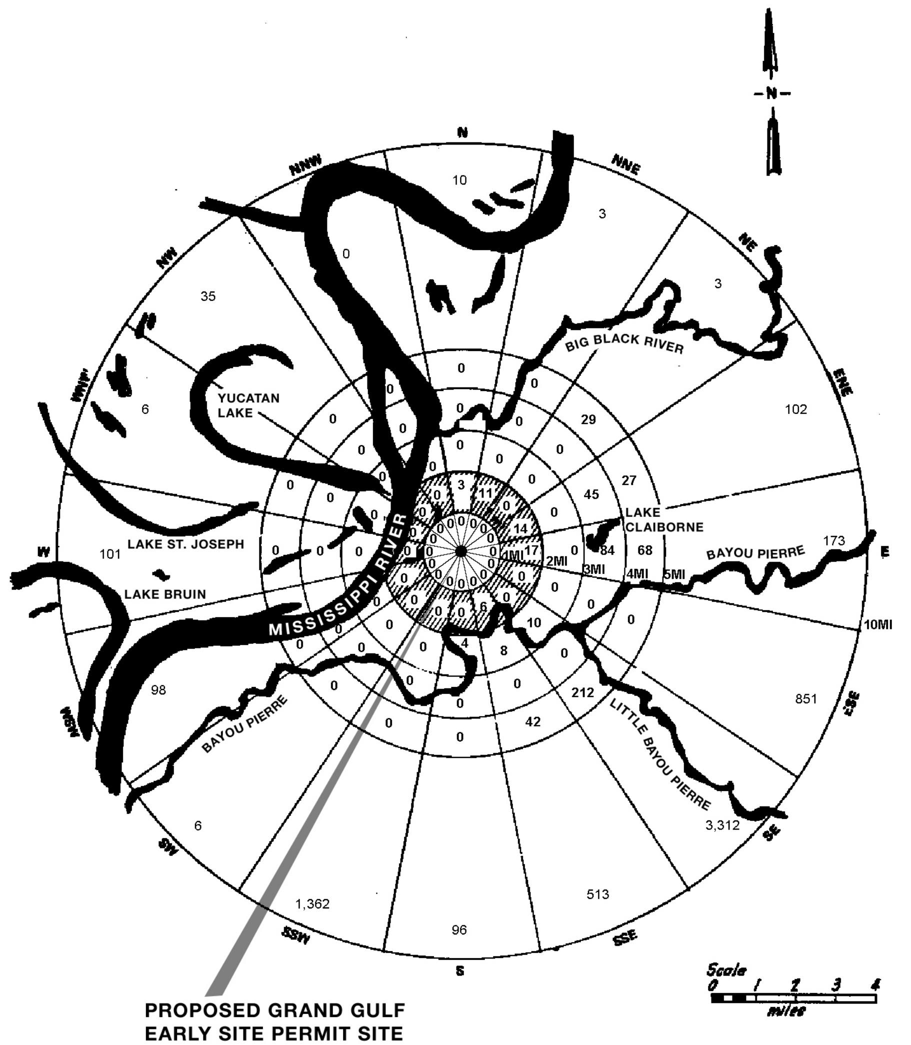

Figure 2-8. Estimated Population in 2002 within 16 Kilometers (10 Miles) of the Grand Gulf Early Site Permit Site (SERI 2005, Figure 2.5-1)

population of 26,407. Clinton, Mississippi, located to the northeast, and Natchez, Mississippi, located to the southwest, had 2000 U.S. Census populations of 23,347 and 18,464, respectively.

Jackson, Mississippi, the largest nearby metropolitan area, located about 88 km (55 mi) northeast of the site, had a 2000 U.S. Census population of 184,256. The larger population centers to the north, northeast, and southwest provide employment, services and entertainment for the region. Rural communities, similar to Port Gibson, are located throughout the outlying areas and provide limited services (USCB 2003).

The estimated population for 2002 and the projected populations for 2030 (the projected first year of operation) and for each decade for five decades through the year 2070 (the projected end of the initial facility license term) are based on the 2000 U.S. Census (see Table H-1 in Appendix H). The projected populations for the years 2030 through 2070 for each segment are based on averages of the population growth projections obtained from the Louisiana State University and the Mississippi Center of Policy Research and Planning for the Louisiana parishes and Mississippi counties, respectively. Discussion regarding the population projection methodology used by the states of Mississippi and Louisiana is provided in Site Safety Analysis Report Section 2.1.3.1 (SERI 2005).

Figure 2-9 shows the estimated resident population in 2002 within 16 to 80 km (10 to 50 mi) of the Grand Gulf ESP facility. The 2002 projected resident population and the population projection for each of five decades from 2030 (the projected first year of facility operation) to 2070 (the projected end of the initial license term) are given in Table H-2 in Appendix H for each area shown in Figure 2-9 formed by concentric circles (distance) and the radial lines (direction). The basis for estimating the projected population distributions is similar to that described for the population distribution within the 0- to 16-km (0- to 10-mi) zone.

The resident and transient population is subject to seasonal variations (from visitors to the Grand Gulf Military Park and hunting camps and from visitors who fish) and daily workday variations (GGNS Unit 1 employment and other activities of an occasional nature, such as the logging crews of forest product company, Anderson-Tully of Vicksburg, Mississippi, who occasionally work on the company's owned and leased land within 8 to 16 km (5 to 10 mi) of the Grand Gulf ESP site) (SERI 2004a). Table 2-11 shows transient population associated with recreation and large employers. Although there are a number of large employers in the general area of the Grand Gulf ESP, commuting data from the 2000 U.S. Census show that more residents commute out of Claiborne, Copiah, Rankin, Jefferson, and Adams County than commute in. The four nearest counties (Claiborne, Copiah, Jefferson, and Warren) show net out-commuting, so that their daytime working population is less than their resident working

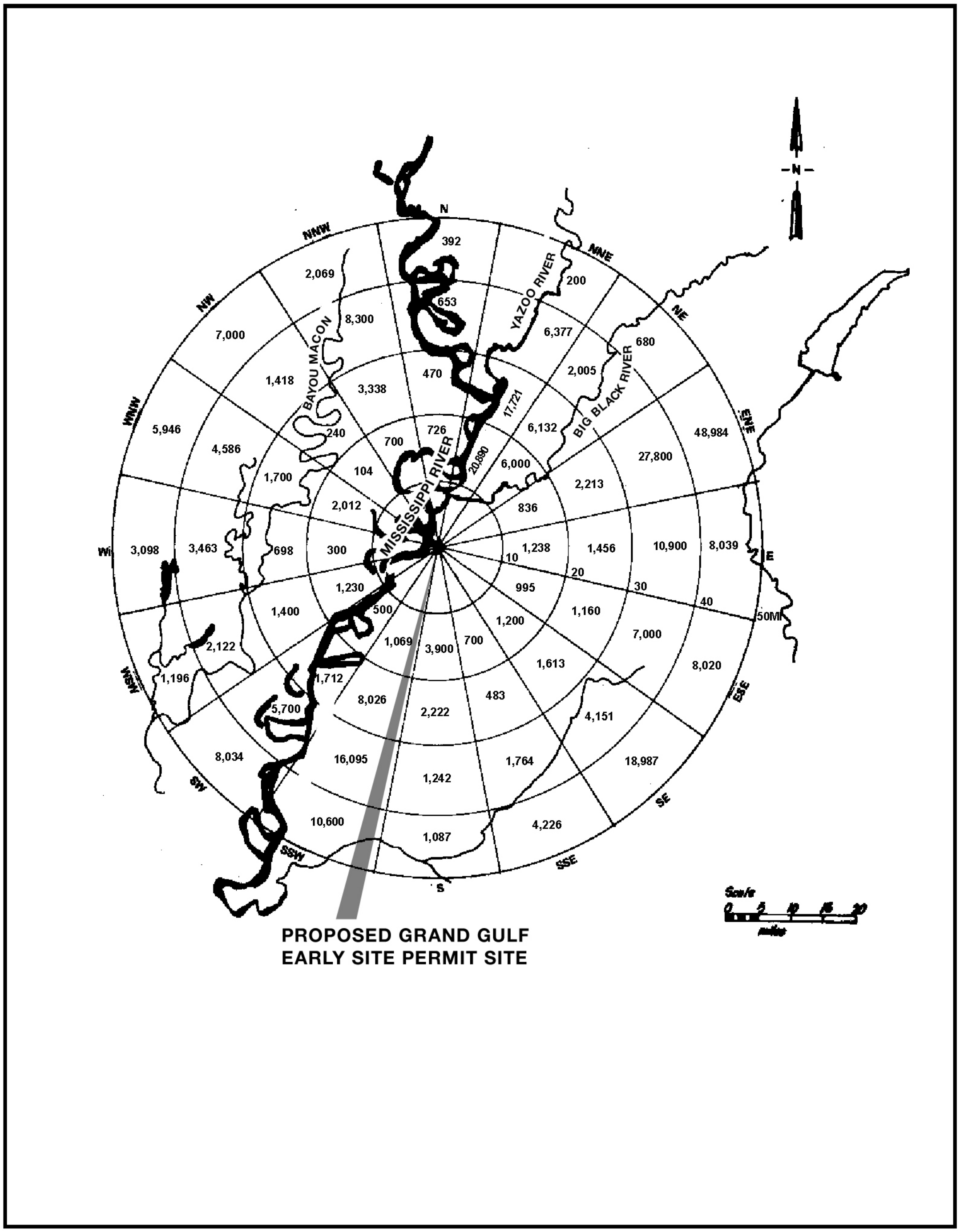

Figure 2-9. Estimated Population in 2002 Between 16 and 80 Kilometers (10 and 50 Miles) from the Grand Gulf Early Site Permit Site (SERI 2005, Figure 2.5-2)

Table 2-11. Transient Population Near Grand Gulf Early Site Permit Site

Location	Peak Time	County/Parish	Distance from GGNS Site	Peak Population
Recreation Visitors				
Grand Gulf Military Park	Sundays in June and July	Claiborne (MS)	2.4 km (1.5 mi)	250-300
Warner Tully YMCA Camp	May-August	Claiborne (MS)	5.6 km (3.5 mi)	120
Lake Claiborne	Summer Weekends	Claiborne (MS)	5.6 km (3.5 mi)	200
Lake Bruin State Park	Summer Weekends	Tensas (LA)	15 km (9.5 mi)	--
Hunting Camps (Mississippi Side)	Hunting Season Weekends	Various	Various	4500
Hunting Camps (Louisiana Side)	Hunting Season Weekends	Various	Various	300-400
Other Hunters	First Day of Gun Hunting	Various	Various	500-600
Anglers	Summer Weekends	Various	Various	200-250
Delta Steamboats	Summer (Largest Vessel)	Various	Various	597
Vicksburg Area Attractions	Summer Weekends	Warren (MS)	Approx 40 km (25 mi)	9800
Selected Major Employers[(a)]				
Grand Gulf Nuclear Station	Outage Weekdays	Claiborne (MS)	--	800
Bruce Hardwood Floors	Weekdays	Claiborne (MS)	10 km (6 mi)	200
Prolon, Inc.	Weekdays	Claiborne (MS)	10 km (6 mi)	90
American Paper Tube	Weekdays	Claiborne (MS)	10 km (6 mi)	20
Alcorn State University	Weekdays (Football Game Days)	Jefferson (MS)	17 km (10.5 mi)	~3300 (20,000)
Panola Company	Weekdays	Tensas (LA)	19 km (12 mi)	42
Texas Road Gin	Weekdays	Tensas (LA)	19 km (12 mi)	40 (Seasonal)
LeTourneau, Inc.	Weekdays	Warren (MS)	24 km (15 mi)	652
Cooper Lighting HID	Weekdays	Warren (MS)	40 km (25 mi)	1005
Anderson-Tully Co.	Weekdays	Warren (MS)	40 km (25 mi)	550
Tyson Foods	Weekdays	Warren (MS)	48 km (30 mi)	650
International Paper Company	Weekdays	Warren (MS)	56 km (35 mi)	370
API Outdoors Inc.	Weekdays	Madison (LA)	56 km (35 mi)	100
International Paper Company	Weekdays	Adams (MS)	56 km (35 mi)	600
Dynasteel Corp.	Weekdays	Adams (MS)	56 km (35 mi)	120
Mississippi River Corp.	Weekdays	Adams (MS)	56 km (35 mi)	100
Kelly's Kids	Weekdays	Adams (MS)	56 km (35 mi)	100
La Sevilla Fashions, Inc.	Weekdays	Franklin (LA)	64 km (40 mi)	250
Mastercrafters Corp	Weekdays	Franklin (LA)	64 km (40 mi)	170
American Railcar Industries	Weekdays	Franklin (MS)	64 km (40 mi)	63
Franklin Timber Co.	Weekdays	Franklin (MS)	64 km (40 mi)	30
Alford Lumber Co.	Weekdays	Franklin (MS)	68 km (42 mi)	30
Delphi	Weekdays	Lincoln (MS)	74 km (46 mi)	617
Columbus Lumber Co., LLC	Weekdays	Lincoln (MS)	74 km (46 mi)	150
Keystone-Seneca Wire Cloth Co.	Weekdays	Lincoln (MS)	74 km (46 mi)	120
Gatlin Corp., Inc.	Weekdays	Lincoln (MS)	74 km (46 mi)	72

(a) Many of the employees reside within 80 km (50 mi) of the site. Peak population is assumed to be the same as employment.

Source: SERI 2005

population (USCB 2005b). SERI calculated a transient population of about 10,700 within 16 km (10 mi) of GGNS for 2002. Between 16 and 48 km (10 and 30 mi), the weighted transient population for 2002 was estimated at about 14,800 (SERI 2005). Total population (transient plus resident population) to 48 km (30 mi) was estimated by SERI at 128,300; this was projected to increase to 137,800 by 2030 and to 152,200 by 2070 (SERI 2005). In 2030, transient population for 0 to 48 km (0 to 30 mi) was projected at 29,800. By 2070, it was projected at 33,000 (vs. 25,500 in 2002). Since much of the projected increase is actually double-counted resident population, the staff considers both the estimate for 2002 and the projections to be overestimates.

2.8.2 Community Characteristics

The community surrounding the Grand Gulf ESP site is rural, largely minority, low-income, and economically isolated (Table 2-12). The county in which the proposed site is located (Claiborne County, Mississippi) and three of the counties next to the proposed site (Copiah and Jefferson counties in Mississippi and Tensas Parish in Louisiana) are classified as persistent poverty counties (Tootle 1999). County poverty estimates in the 2000 U.S. Census indicate that 32.4 percent of individuals are below the poverty level in Claiborne County, compared to the state of Mississippi with 19.9 percent of individuals below the poverty level (USCB 2004c).

Table 2-12. Minority and Low-Income Populations

	Percentage Minority	Percentage Low Income
United States	30.9	12.4
Mississippi	39.3	19.9
Counties Within 50 km (80 mi)	27.9	21.0
Claiborne County	84.9	32.4
Port Gibson	80.6	31.3

Sources: USCB 2003, 2004f

2.8.2.1 Economy

Approximately 750 people work at GGNS Unit 1, with up to 970 personnel onsite during outages (SERI 2005), making Entergy one of the large, stable employers in the four-county region. Table 2-13 shows an April 2003 distribution of residence locations of SERI's employees at GGNS. About 46 percent of the employees lived in Warren County (Vicksburg), about 18 percent in Claiborne County, 15 percent in Hinds County, almost 6 percent in Jefferson County, over 4 percent each in Copiah and Franklin counties, almost 3 percent in Lincoln County, and the rest scattered.

Table 2-13. Residence Locations of the Workforce at the Grand Gulf Nuclear Station, April 2003

	Number[(a)]	Percent of Workforce
Claiborne County	**125**	**17.9**
Port Gibson	102	14.6
Pattison	12	1.7
Hermanville	10	1.4
Warren County	**325**	**46.4**
Vicksburg	325	46.4
Hinds County	**106**	**15.1**
Clinton	51	7.3
Jackson	19	2.7
Raymond	11	1.6
Utica	10	1.4
Jefferson County	**40**	**5.7**
Fayette	27	3.9
Lorman	13	1.9
Copiah County	**31**	**4.4**
Wesson	16	2.3
Hazelurst	12	1.7
Franklin County	**30**	**4.3**
Natchez	23	3.3
Lincoln County	**20**	**2.9**
Brookhaven	19	2.7
Other	**23**	**3.3**
Total	**700**	**100.0**

(a) The cities listed are those with at least ten resident workers and are not all of the cities that make up the county total.
Source: SERI 2004a

Comparisons of county employment statistics by industry type indicate that the total number of jobs for Claiborne County and the two adjacent Mississippi counties (Copiah and Jefferson) decreased between 1990 and 2000, offset by gains in Hinds and Warren counties (see Table 2-14). Several industries experienced severe job decline between 1990 and 2000, including agriculture, forestry, and fishing jobs (down almost 50 percent); manufacturing; professional, scientific, management, administrative, waste management, and other services jobs (each down almost 16 percent); wholesale trade (down 13 percent); finance, insurance, real estate, and rental and leasing (down 11 percent); and construction (down 2 percent) (USCB 2004a, 2004e). In contrast, employment in retail trade and entertainment services increased by 15 percent; public administration by over 14 percent; transportation and warehousing, utilities, and information services by 11 percent; and educational, health, and social services by 10 percent. A study conducted by the Rural Health Works in Mississippi estimates that employment in the health care sector represents 5.3 percent of the total

Table 2-14. Employment Changes in the Five Mississippi Counties Nearest to the Grand Gulf Early Site Permit Site (Claiborne, Copiah, Hinds, Jefferson, and Warren), 1990 to 2000

Mississippi County	Workers Employed 1990	Workers Employed 2000	Percentage Change in Workers Employed 1990-2000	Percentage Unemployment Rate 1990	Percentage Unemployment Rate 2000
Claiborne	3,490	2,990	-14.3	15.3	11.8
Copiah	10,540	10,420	-1.1	9.4	7.7
Hinds	121,360	125,340	3.3	5.6	4.7
Jefferson	2,300	2,230	-3.0	22.8	19.5
Warren	20,780	25,630	23.3	7.5	5.0
Totals	**158,470**	**166,610**	**5.1**	**6.6**	**5.3**

Source: SERI 2004a

workforce within Claiborne County. The study also concludes that local health care services typically represent a much larger sector of rural economies than for urban communities (Berry et al. 2002).

The annual 2004 county labor force data show Claiborne County had an unemployment rate of 10.1 percent as compared to the surrounding four contiguous counties in Mississippi (Copiah, Hinds, Jefferson, and Warren) and Tensas Parish, Louisiana. The surrounding counties had an average unemployment rate of 6.0 percent, and the state of Mississippi had an unemployment rate of 6.2 percent (U.S. Bureau of Labor Statistics 2005).

2.8.2.2 Transportation

Transportation routes are limited in the vicinity of the Grand Gulf ESP site. The major highway in the vicinity is U.S. Highway 61, which passes by the existing GGNS to the east-southeast. U.S. Highway 61 parallels the Mississippi River from New Orleans, Louisiana to St. Louis, Missouri. This highway runs through Port Gibson and is approximately 7.2 km (4.5 mi) from the Grand Gulf ESP site at the closest point. From the town of Port Gibson, the highway goes north to Vicksburg, Mississippi, and runs southwest to Natchez, Mississippi.

The Natchez Trace Parkway lies east of Port Gibson and runs southeast to Natchez and northeast to Clinton, Mississippi. Figure 2-10 shows the estimated average daily traffic count in 2000 on roads in the vicinity of the Grand Gulf ESP site. Bald Hill Road has been reconstructed from Grand Gulf Road to Headly Road to accommodate commercial traffic to/from

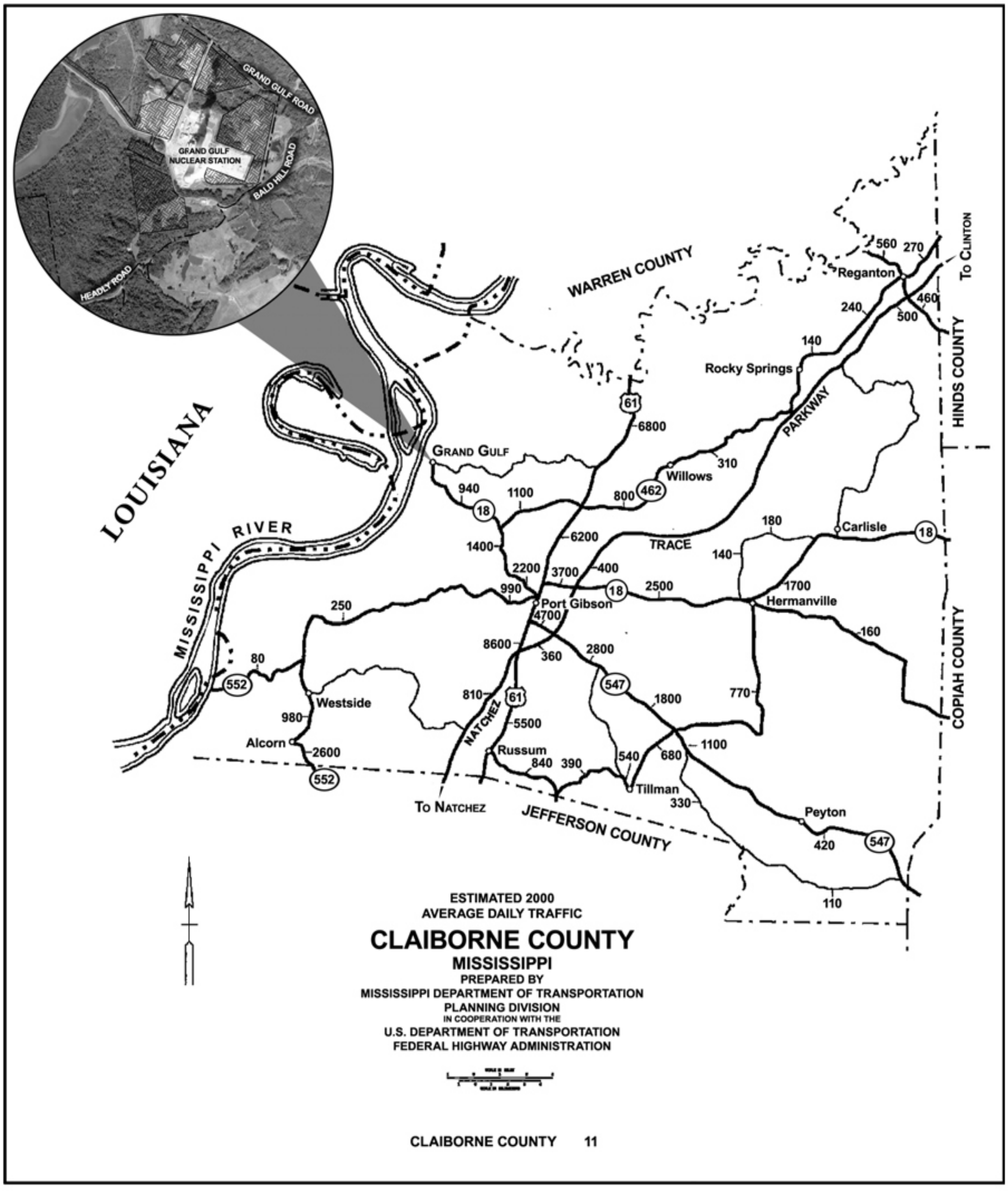

Figure 2-10. Estimated Average Daily Traffic in Claiborne County, Mississippi in 2000 (adapted from SERI 2005, Figure 2.5-3)

Port Claiborne. New highway construction to extend the present path of Highway 18 is scheduled for early 2006 (see Figure 2-11). This proposed extension will connect Highway 18 to Grand Gulf Road, providing additional access to the Grand Gulf ESP site (SERI 2004a; Williford, Gearhart, and Knight 2005).

A Kansas City Southern freight train passes within 45 km (28 mi) to the north-northeast of the site twice daily. The train runs from Vicksburg to Meridian, Mississippi, then returns to Vicksburg (KCS 2002). No rail line serves Claiborne County or the Grand Gulf site directly (MDOT 2004b). An active spur line from the Kansas City Southern line runs south from Vicksburg about 11 km (7 mi).

2.8.2.3 Taxes

Mississippi Code Title 27 addresses taxation of nuclear generating plants and the distribution of tax revenues from nuclear plants (Mississippi Tax Code 2003). This code states that any nuclear generating plant located in the State, which is owned or operated by a public utility rendering electric service within the State, is exempt from county, municipal, and district ad valorem taxes. In lieu of the payment of county, municipal, and district ad valorem taxes, the nuclear power plant owner pays the State Tax Commission a sum based on the assessed value of the nuclear generating plant.

GGNS is taxed by the State for a sum equal to 2 percent of the assessed value but not less than $20 million annually. At least $7.8 million goes to Claiborne County (SERI 2004c). Of this amount, $3 million is allocated contingent upon Claiborne County upholding its commitment to the GGNS offsite emergency plan. The $7.8 million represents roughly 83 percent of all Claiborne County revenues (Mississippi State 2002).

The Mississippi State Tax Commission transfers $160,000 annually to the town of Port Gibson provided that the city maintains its commitment to the GGNS offsite emergency plan. Ten percent of the remainder of the payments are transferred from the Mississippi State Tax Commission to the General Fund of the State. The balance of the tax revenue from the GGNS site is transferred to the counties and municipalities in the state of Mississippi where electric service is provided. The tax revenues are distributed in proportion to the amount of electric energy consumed by the retail customers in each county, with no county receiving an excess of 20 percent of the funds (Mississippi Tax Code 2003). This distribution, based on energy consumed, also includes Claiborne County.

Depending on the type of facility (unregulated merchant facility or a facility regulated by the Public Service Commissions of Mississippi and Louisiana), the tax structure of the Grand Gulf ESP facility may be similar to the above for GGNS (a regulated facility), or may be some mutually agreeable amount for an unregulated merchant facility.

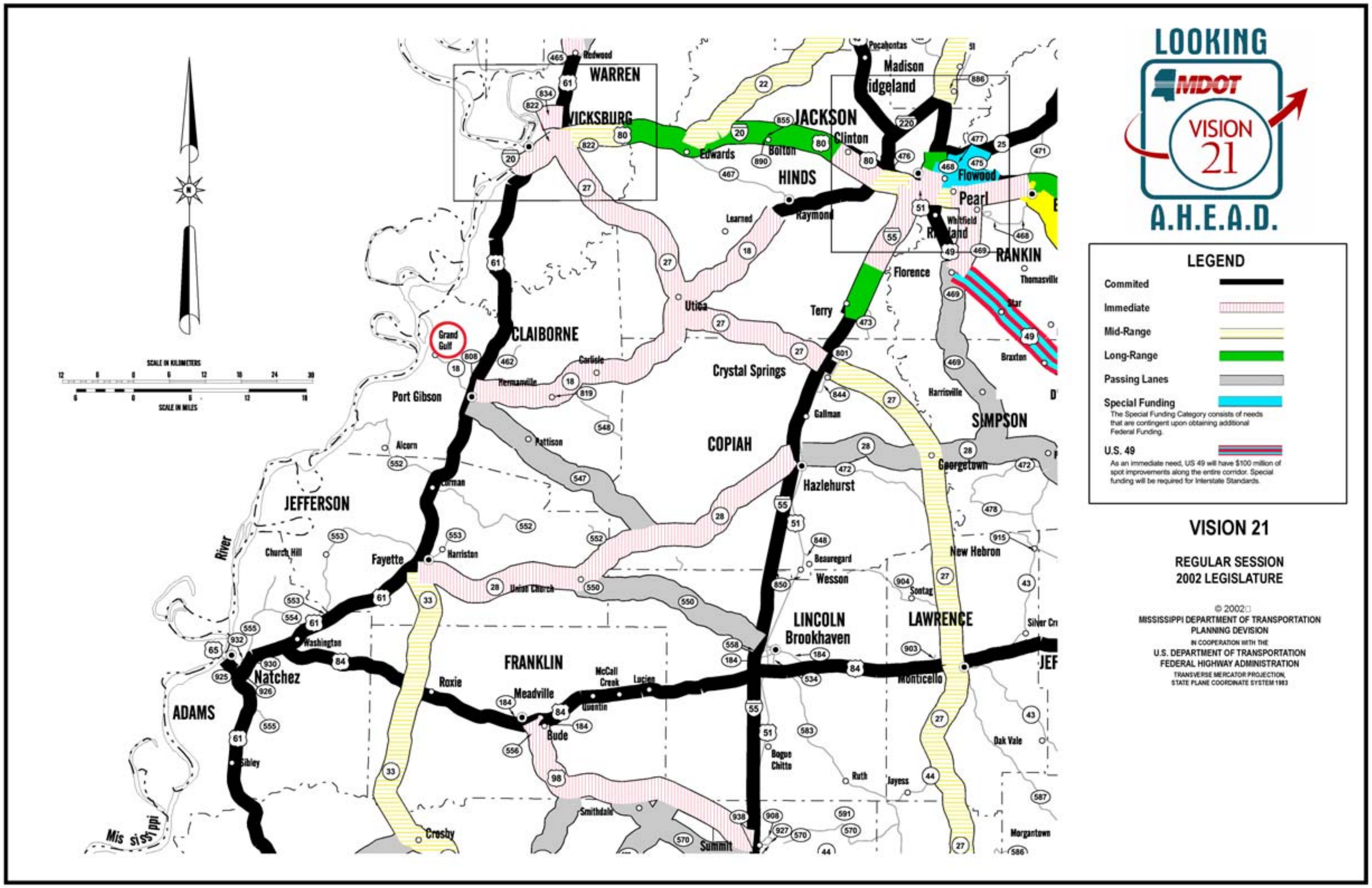

Figure 2-11. Mississippi Department of Transportation 2002 Road Development Plan (adapted from SERI 2005, Figure 2.5-4)

2.8.2.4 Aesthetics and Recreation

The Grand Gulf Military Park is located approximately 3 km (2 mi) north of the location proposed for the Grand Gulf ESP power block and is contiguous to the GGNS site. The park is open daily and had over 88,000 visitors in 2001. The highest volume of guests visit the park on Sundays while Saturday is typically the second largest attendance day. The park is most heavily used during the months of June and July when 250 to 300 people visit the site per day, depending on the weather conditions (SERI 2004a).

The Warner-Tully YMCA Camp consists of 44 ha (108 ac) of land located approximately 5 km (3 mi) northeast of the Grand Gulf ESP site. Approximately 800 campers use the Warner-Tully Camp facilities each year. The YMCA camp is open from late May to the end of August (SERI 2004a).

Lake Claiborne is a private development of residential and recreational facilities, located approximately 5 km (3 mi) east of the Grand Gulf ESP site. Lake Claiborne, Inc., has a total of about 450 members who have access to the lake and picnic area. There are 51 permanent residents in the development. A maximum of 200 people use these facilities on a summer weekend (SERI 2005).

Lake Bruin State Park consists of 21 ha (53 ac) located on the shore of Lake Bruin, Louisiana, approximately 15 km (9.5 mi) southwest of the proposed site. From July 2001 to June 2002, the park had approximately 36,000 visitors (SERI 2004a).

There are approximately 150 hunting camps within Claiborne County. These camps are primarily used for deer hunting and other types of hunting as well as sport fishing. The camps are too numerous to estimate an accurate number of people who use them. Each camp, depending on the size of the camp, could have up to 20-30 hunters on a weekend day during hunting season (SERI 2004a).

Several hunting clubs are located across the Mississippi River from the Grand Gulf ESP site in Tensas Parish, Louisiana. About 300 to 400 deer and duck hunters are members of these clubs (SERI 2004a).

Deer season in Mississippi traditionally opens early in October for archery and late November for guns. The season continues through early January. The greatest number of hunters, approximately 500 to 600, typically hunt within the vicinity on the first day of gun season. After the opening weekend, approximately 70 percent of the hunting population use the camps until the end of the season in early January (SERI 2004a). Louisiana deer season is similar in duration to that of Mississippi, beginning in early October and ending in late January (LFWS 2004).

Sport fishing in the area occurs in the months of April through September with Saturday being the busiest day of the week. As many as 200 to 250 anglers may be in the vicinity on weekends during the months noted. The number of anglers may drop to fewer than 150 during the week, depending on the weather conditions (SERI 2004a).

The Delta Queen Steamboat Company operates three paddle wheel tour boats on the Mississippi River: the Delta Queen (174 passengers), the Mississippi Queen (416 passengers), and the American Queen (436 passengers) (DQSC 2004a). Scheduled departures and ports of call indicate that these vessels pass the Grand Gulf ESP site several times during the season, from April through November (DQSC 2004b).

The GGNS site is visible from Grand Gulf Military Park and the existing natural draft cooling tower is visible from the Mississippi River. Otherwise, the site is well screened by topography and forested areas surrounding it. The Grand Gulf ESP site is therefore already aesthetically altered by the presence of an existing nuclear power plant and cooling tower.

2.8.2.5 Housing

There were 226,000 occupied housing units reported in the 2000 U.S. Census for the counties that currently supply workers to the GGNS. Table 2-15 provides regional housing information by county for these counties. U.S. Census data for 2000 indicates 567 vacant housing units are located within Claiborne County, representing 13 percent of the total housing in the county (USCB 2004d). In the ten-county area, 21,760 housing units were reported as vacant for the 2000 U.S. Census. Based on the vacancy numbers, no overall housing shortage appears to exist in the region, although availability is more limited in Claiborne County and Jefferson County. From 2000 to 2004, mortgage loan amounts (a proxy for housing prices) in Claiborne County have risen slowly in a thin market, indicating little activity but no evidence of declining values (Section 5.1.1).

2.8.2.6 Public Services

Water Supply and Waste Treatment

Port Gibson Water Works supplies Port Gibson with municipal water and sewer services. Approximately 95 percent of Port Gibson's population is connected to the municipal water and sewer system, which is presently at 90 percent capacity. Operational averages for the water and sewer services provided by Port Gibson Water Works are provided in Table 2-16.

GGNS has its own water and sewage facility. The GGNS currently operates at about one-third capacity during normal operation and two-thirds capacity during outages. The facility consumes 379,000 L/d (100,000 gpd) of water for general operations and separately uses 189,000 L/day (50,000 gpd) for the activated sludge system (SERI 2005).

Table 2-15. Regional Housing Information by County for the Year 2000

Mississippi County	Total Housing Unit	Occupied	Owner Occupied	Renter Occupied	Vacant Housing	Seasonal/ Recreational
Adams	15,175	13,677	9,615	4,062	1,498	176
Claiborne	4,252	3,685	2,956	729	567	149
Copiah	11,101	10,142	8,107	2,035	959	176
Franklin	4,119	3,211	2,764	447	908	434
Hinds	100,287	91,030	58,131	32,899	9,257	421
Jefferson	3,819	3,308	2,658	650	511	169
Lincoln	14,052	12,538	9,788	2,750	1,514	205
Madison	28,781	27,219	19,288	7,931	1,532	203
Rankin	45,070	42,089	32,471	9,618	2,981	393
Warren	20,789	18,756	12,785	5,971	2,033	199
Total	**247,445**	**225,655**	**158,563**	**67,092**	**21,760**	**2,525**

Source: USCB 2004d

Table 2-16. Capacity and Use of Port Gibson Water and Sewer Systems

Units	Maximum Well Water Capacity	Average Well Water Consumption	Peak Well Water Consumption	Water Storage Capacity	Sewer Capacity
Liters/Day	3.8 million	3,000,000	3,600,000	2,840,000	760,000
Gallons/Day	1 million	800,000	950,000	750,000	200,000

Source: SERI 2005

Police, Fire, and Medical

The Claiborne County Sheriff's department handles the present duties for law enforcement within the immediate (8-km (5-mi)) area of the Grand Gulf ESP site. Additional law enforcement resources from the town of Port Gibson assist when needed. GGNS maintains its own security force to handle security within the Grand Gulf site property boundaries.

Fire capabilities are maintained by Claiborne County Fire Department along with the volunteer fire department from the town of Port Gibson. GGNS Unit 1 maintains an emergency response team onsite, including a fire brigade to respond to fires within the facility buildings and structures.

Emergency planning responsibilities are assigned to a number of departments and agencies. Federal, State, and local officials will implement appropriate protective actions in case of an emergency (MDOT 2004a; Scott 2004). The Claiborne County Sheriff's Department has performed adequately in all of its offsite emergency responsibilities in Federal Emergency Management Agency emergency planning exercises. However, with a staff of only nine deputies, the department has concerns about the adequacy of its staffing to cover simultaneously its emergency responsibilities at GGNS as well as offsite evacuation in the event of actual emergencies (Scott 2004).

The Claiborne County Hospital has 32 beds. The staff consists of five doctors, ten registered nurses, six nurse's aides, and three X-ray technicians (SERI 2004a). Information for hospitals located in the adjoining counties is listed in Table 2-17 (SERI 2004a). The local hospital does not have the full range of services available all of the time. A Mississippi Department of Health publication in 2003 indicated that Claiborne County is a health professional shortage area (MDH 2005a). Residents of Claiborne County obtain a significant proportion of their hospital services in Vicksburg rather than locally (Berry et al. 2002). In an emergency, the Claiborne County Hospital has the space, equipment, and staff to handle about three to four casualties at a time. It has one decontamination room (14 years old) that is not co-located with the emergency room. Claiborne County officials are concerned this is not sufficient should there be an emergency at the Grand Gulf ESP facility. They believe their communications and transportation capability to evacuate patients is not adequate. County officials do have verbal agreements and are in contact with other licensed facilities within 96 km (60 mi) and believe that emergency responders would come to help from other counties, but they would like to have much more capability under local control (Scott 2004).

Table 2-17. Hospitals in the Vicinity of the Grand Gulf Early Site Permit Site

County	Number of Hospitals	Number of Beds
Claiborne	1	32
Copiah	1	49
Hinds	6	2468
Jefferson	1	30
Warren	2	354
Total	**11**	**2933**

Source: SERI 2004a

2.8.2.7 Education

Claiborne County and the four adjacent counties in Mississippi contain 114 primary and secondary schools with a student population of 61,097 (see Table 2-18).

Table 2-18. Number of Students and Public Primary and Secondary Schools in Mississippi Counties Surrounding the Grand Gulf Early Site Permit Site

Mississippi County	Number of Schools	Student Population
Claiborne	4	2,011
Copiah	6	4,911
Hinds	85	43,281
Jefferson	5	1,714
Warren	14	9,180
Total	**114**	**61,097**

Source: NCES 2002

2.9 Historic and Cultural Resources

This section discusses the cultural background and the known and potential historic and cultural resources at the Grand Gulf ESP site and surrounding environs of Claiborne County.

2.9.1 Cultural Background

The area in and around the Grand Gulf ESP site has a rich history and has demonstrated the presence of significant prehistoric and historic cultural resources. Thirty-five sites in Claiborne County are eligible for listing on the National Register of Historic Places, sixteen of which are located within the 16-km (10-mi) vicinity of the Grand Gulf ESP site (SERI 2005). These are mostly historic buildings, homes, churches, and cemeteries.

One site, the Grand Gulf Military Park, a 162-ha (400-ac) park listed in the National Register of Historic Places, is located adjacent to the GGNS. Within the park are archaeological deposits, standing structures, objects, and artifacts from the historic town of Grand Gulf and from Civil War events that occurred in the area. Files at the Mississippi Department of Archives and History indicate that a total of 13 archaeological sites, including the park site, are within 3 km (2 mi) of the Grand Gulf ESP site, none of which are eligible for listing on the National Register of Historic Places.

Although no prehistoric sequence has been published for the immediate area, the general sequence for the region can be described as follows:

- 10,000 - 8000 B.C. During this period, the area was sparsely inhabited by peoples typically referred to as big-game hunters.

- 8000 - 2000 B.C. People developed a more generalized hunting and gathering economy and spread throughout the Mississippi valley. People would move from place to place, obtaining foods and other items as they became seasonally available.

- 2000 B.C. - A.D. 1000. The economy changed from seasonal food gathering to settled life. Small villages developed around mounds of earth constructed by the people to bury their dead.

- A.D. 1000 - 1542. The economy added farming crops, such as corn, beans, and squash. Earth mounds developed into flat-topped "temple" mounds as population densities increased.

- A.D. 1542 - ca.1650. Diseases brought on by contact with Europeans led to massive epidemics, decimating the local American Indian populations.

Settlement by non-Indians increased throughout the 1700s as settlers moved into the frontier. American Indian groups such as the Choctaw, Chickasaw, Natchez, Tunica, and others resisted the new inhabitants but eventually abandoned traditional lands, moving to areas where they were less threatened by the dominant population. During this time, Mississippi went from being a French possession to an English possession in 1763, to a Spanish possession in 1781, and eventually to the United States in 1795. Mississippi became a U.S. Territory in 1798, and achieved statehood in 1817 (Headley 1996).

Port Gibson was founded in 1783 as the first settlement in the general area, serving the surrounding rural farms, where the main crops grown were cotton, corn, field peas, oats, and sweet potatoes (Hendrickson and McKeehen 1926). In 1802, the residents organized Claiborne County, which became the second area in Mississippi to achieve this status. By this time, the area was populated mainly by Anglo-Americans from the east and peoples of African descent. A second shipping point, Grand Gulf, formed in 1833. Grand Gulf eventually decreased in importance and faced heavy erosion in later years. An important Civil War battle occurred there in 1861 (Bearss 1989).

2.9.2 Historic and Cultural Resources at the Grand Gulf ESP Site

When the original GGNS site was planned, an archaeological survey of the 850-ha (2100-ac) proposed site was commissioned by MP&L. The survey, performed by the Mississippi Department of Archives and History, identified eight prehistoric sites on the GGNS site (Brookes and Inmon 1973). Seven of the sites were scatters of lithic and ceramic debris and were not considered important enough for inclusion in the National Register of Historic Places. These sites are designated 22-Cb-523 though 22-Cb-529, using the Smithsonian archaeological site numbering system. These sites were located in the zone of construction and were likely destroyed or are located outside the Grand Gulf ESP site.

Three sites not located in an area of proposed construction have been investigated: Grand Gulf Mound, Callendar House, and the Grand Gulf and Port Gibson railroad. Grand Gulf Mound (22-Cb-522), the eighth prehistoric site, was considered important enough to excavate. This was a burial mound located on a terrace on the bluffs overlooking the Mississippi River. More than half the mound had been damaged by artifact collectors and other activities by the time Mississippi Department of Archives and History visited it in 1972 (Brookes 1976). Following the recommendation of the Department, MP&L fenced the mound. The Department commenced excavation soon thereafter. The investigators concluded this was an early Marksville burial mound dating from approximately A.D. 50 to A.D. 200. Evidence indicated an affinity to peoples in the north, probably the Illinois Valley. Today the fence is still standing, but little remains of the mound.

In addition to the archaeological investigations conducted prior to construction of GGNS, MP&L commissioned a survey of the existing architectural resources of Claiborne County (Douglas 1974). One resource, the Callendar House, a mid-19th century simple Greek Revival house unique to the county, was located on the eastern portion of the GGNS (Douglas 1974). The house was built by C.D. and Lizzie Hamilton about 1866 and later owned by the Maxwell brothers and finally the Callendar family (Headley 1996). In the early 1970s, the house was in poor condition, and despite an interest in preserving the house, it did not survive. NRC staff inspected the house location on April 13, 2004 (Stapp 2004). Portions of the Callendar House site had been quarried for soil, and no evidence of the house was found on the surface. A barn, ca. 1920s, was still standing and evidence of roads and fields remained. The Callendar House site is considered an unrecorded archaeological resource, as subsurface archaeological deposits probably exist. However, the site likely would not be considered eligible for listing on the National Register of Historic Places because of a lack of integrity.

Finally, a 100-m (300-ft) segment of an important 19th century historic railroad, known as the Grand Gulf and Port Gibson Railroad, still exists within the site boundary and was inspected by NRC staff on April 13, 2004 (Stapp 2004). The steel rails are gone, but the railroad bed exists in good condition; it is not located in an area proposed for new construction. Discussions with

Mississippi Department of Archives and History personnel indicate this would not be the best representative portion of the railroad to preserve and, therefore, no mitigation would likely be required should this portion be affected during facility construction (Stapp 2004).

2.9.3 Historic and Cultural Resources Consultation

To meet consultation requirements found in the National Historic Preservation Act of 1966, as amended, and NEPA, the NRC staff elected to integrate its compliance with the National Historic Preservation Act with its NEPA review, in accordance with 36 CFR 800.8. The NRC staff informed the public about the ESP application and consulted with various entities. A public scoping meeting for the EIS was held on January 21, 2004, in Port Gibson. No comments specific to historic or cultural resources were made at the meeting.

As part of the NEPA/National Historic Preservation Act integrated review, the NRC staff initiated consultation with the Advisory Council on Historic Preservation, the Mississippi Department of Archives and History, the Mississippi Band of Choctaw Indians, the Choctaw Nation of Oklahoma, and the Tunika Biloxi Indian Tribe of Louisiana (NRC 2004q, 2004r, 2004s, 2004t, 2004u, respectively). None of the organizations identified deficiencies in the NRC staff's identification and assessment of the effects of the proposed action on any historic or cultural resources.

On April 14, 2004, the NRC staff met with staff from the Grand Gulf Military Park to discuss potential visual effects of the proposed cooling tower and any other issues of concern; no concerns were identified (Stapp 2004).

NRC staff also initiated discussions with the Mississippi Department of Archives and History and the Vicksburg National Military Park to understand potential impacts on historic and cultural resources. The Mississippi Department of Archives and History recommended that if construction efforts were to occur in two specific areas, one located north and one southwest of the GGNS, archaeological investigations should be undertaken prior to construction (SERI 2005) (see Section 4.6). Staff affiliated with the Vicksburg National Military Park indicated that it was unlikely that any significant Civil War-era resources would be affected by the planned activities (SERI 2005).

2.10 Environmental Justice

Environmental justice refers to a Federal policy under which each executive agency identifies and addresses, as appropriate, disproportionately high and adverse impacts on human health or environmental effects of its programs, policies, and activities on minority[(a)] or low-income populations. Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under NEPA. The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. The staff uses as guidance the NRC Office of Nuclear Reactor Regulation office instruction number LIC-203 (NRC 2001[(b)]).

The staff examined the geographic distribution of minority and low-income populations within 80 km (50 mi) of the Grand Gulf ESP site, employing the 2000 U.S. Census for minority and low-income populations (USCB 2004e). The populations within 80 km (50 mi) of the Grand Gulf ESP site encompassed parts of sixteen counties in Mississippi and nine parishes in Louisiana. The staff supplemented its analysis by field inquires to county planning departments, social service agencies, and county personnel in Claiborne, Jefferson, and Warren counties in Mississippi. NRC guidance encourages supplemental inquiries to ensure that minority and low-income groups are not overlooked.

For the purpose of the staff's review, a minority population is defined to exist if the percentage of each minority, or aggregated minority category within the census block groups[(c)] potentially affected by the ESP for the Grand Gulf ESP site, exceeds the corresponding percentage of minorities in the entire state of Mississippi or Louisiana by 20 percent, or if the corresponding percentage of minorities within the census block group is at least 50 percent. A low-income population is defined to exist if the percentage of low-income population within a census block group exceeds the corresponding percentage of low-income population in the entire state of Mississippi or Louisiana (as applicable) by 20 percent, or if the corresponding percentage of low-income population within a census block group is at least 50 percent.[(d)]

(a) Minority categories are defined as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; Hispanic ethnicity; and "other," considered a separate minority category. The 2000 U.S. Census included multi-racial data. Some minority populations can be composed of one or more minority races (USCB 2005a).

(b) NRC also issued a policy statement on Environmental Justice and an update to LIC 203 (see 69 FR 52040 and NRC 2004a, respectively).

(b) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the U.S. Census Bureau (USCB) collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with USCB guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (USCB 2004b).

(d) Low-income households should be identified using the annual statistical poverty threshold from the U.S. Census Bureau (NRC 2004a).

The staff followed the convention of employing 2000 U.S. Census block group data to identify minority and low-income block groups within the 80-km (50-mi) radius of the Grand Gulf ESP site. Using this convention, the 80-km (50-mi) radius includes 129 census block groups for minority populations and 34 census block groups for low-income populations. Both Mississippi and Louisiana have relatively large percentages of low-income and minority persons. Figures 2-12 and 2-13 (which are based on the 20 percent and 50 percent rules described in this section) show those areas that have exceptionally high minority populations and exceptionally high proportions of low-income households within the 80-km (50-mi) radius of the Grand Gulf ESP site. Minority populations are present in all of the counties and parishes within the 80-km (50-mi) radius of the Grand Gulf ESP site. Minority populations are primarily concentrated on the Mississippi side of the river in Claiborne and Jefferson counties, and Hinds County has the largest number of minorities. Claiborne County is entirely composed of minority block groups and contains 10 of the 129 block groups containing exceptionally significant minority populations.

Data from the 2000 U.S. Census characterize low-income populations within the 80-km (50-mi) radius of the Grand Gulf ESP site. The United States' percentage of low income population was 12.4 percent in the 2000 U.S. Census, while in Louisiana it was 19.2 percent and in Mississippi 19.9 percent (USCB 2004e). Applying the NRC criterion of "more than 20 percent greater than the state" yields the census block groups containing exceptionally high percentages of low-income households. Figure 2-13 shows these locations of the exceptionally high percentages of low-income populations within 80 km (50 mi) of the Grand Gulf ESP site. In fact, most of the area near the proposed site, especially Claiborne and Jefferson counties, has percentages of low-income populations in the range of 20 to 30 percent of the population. Nine out of 10 census block groups in Claiborne County, 17 out of 24 in Copiah County, 5 out of 6 in Jefferson County, 12 out of 18 in Concordia Parish, and 6 out of 7 in Tensas Parish have low-income persons making up more than 20 percent of the population. The heaviest concentrations of low-income populations are in southern Claiborne County, central Jefferson County, and eastern Tensas and Concordia parishes (USCB 2004e).

Data were gathered on the health status of the total and Black/African American populations in Claiborne County and were compared with data available at the state and national level. Data are shown in Table 2-19. Local death rate data are not available by income level.

Although Table 2-19 does not show directly age-adjusted cancer death rates by sex, the low combined rates for both sexes are low enough that the age-adjusted cancer death rates are likely to be somewhat lower for Claiborne County residents of both sexes than for either Mississippi or for the United States as a whole. Moreover, the Black/African American population has a lower death rate due to cancer than the total population in Claiborne County, whereas elsewhere in Mississippi and in the nation the rate for Blacks/African Americans is higher. The comparison of infant mortality rates in the county is not meaningful because of the

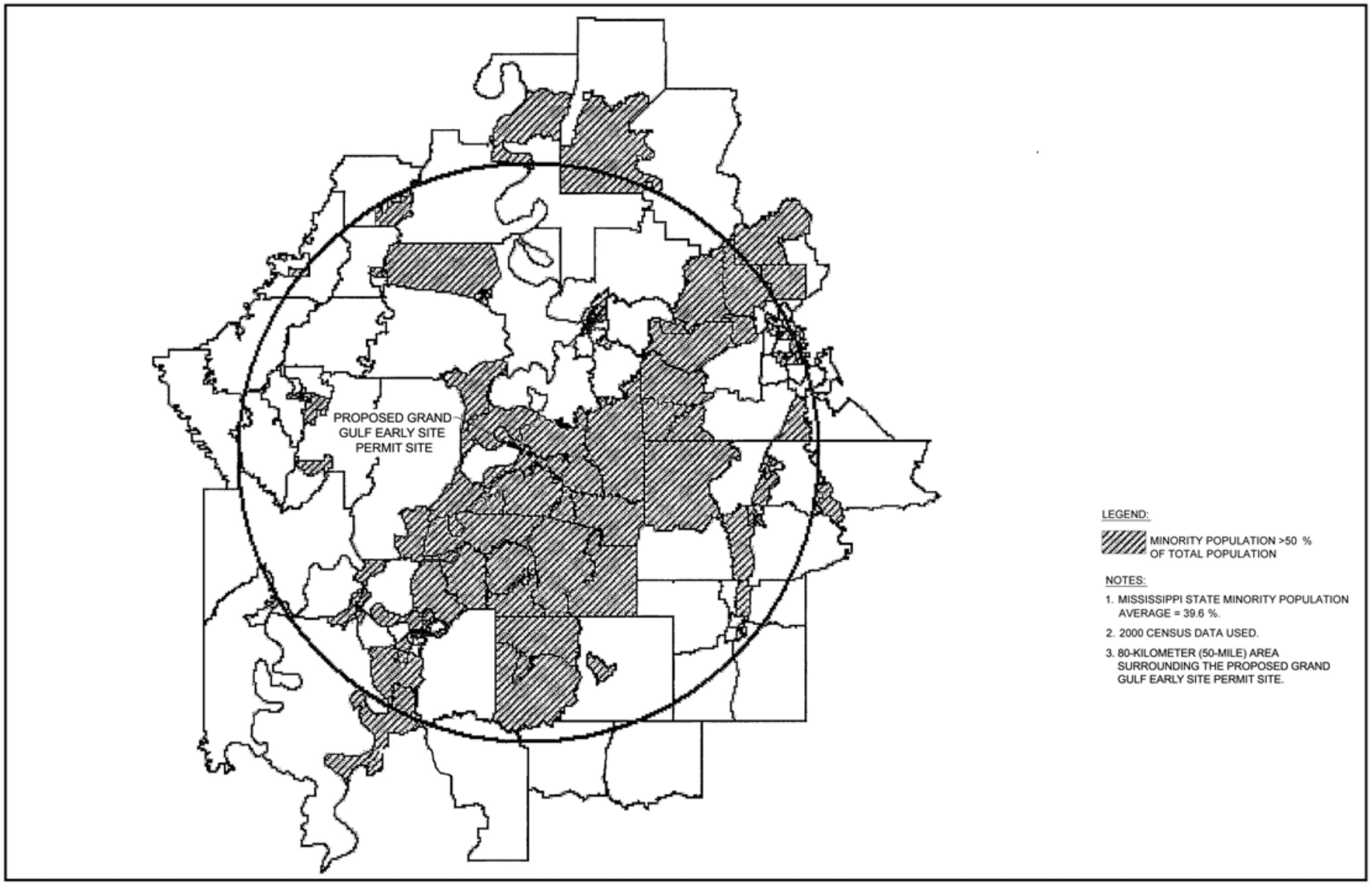

Figure 2-12. Minority Populations within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site (adapted from SERI 2005, Figures 2.5-6, 2.5-7)

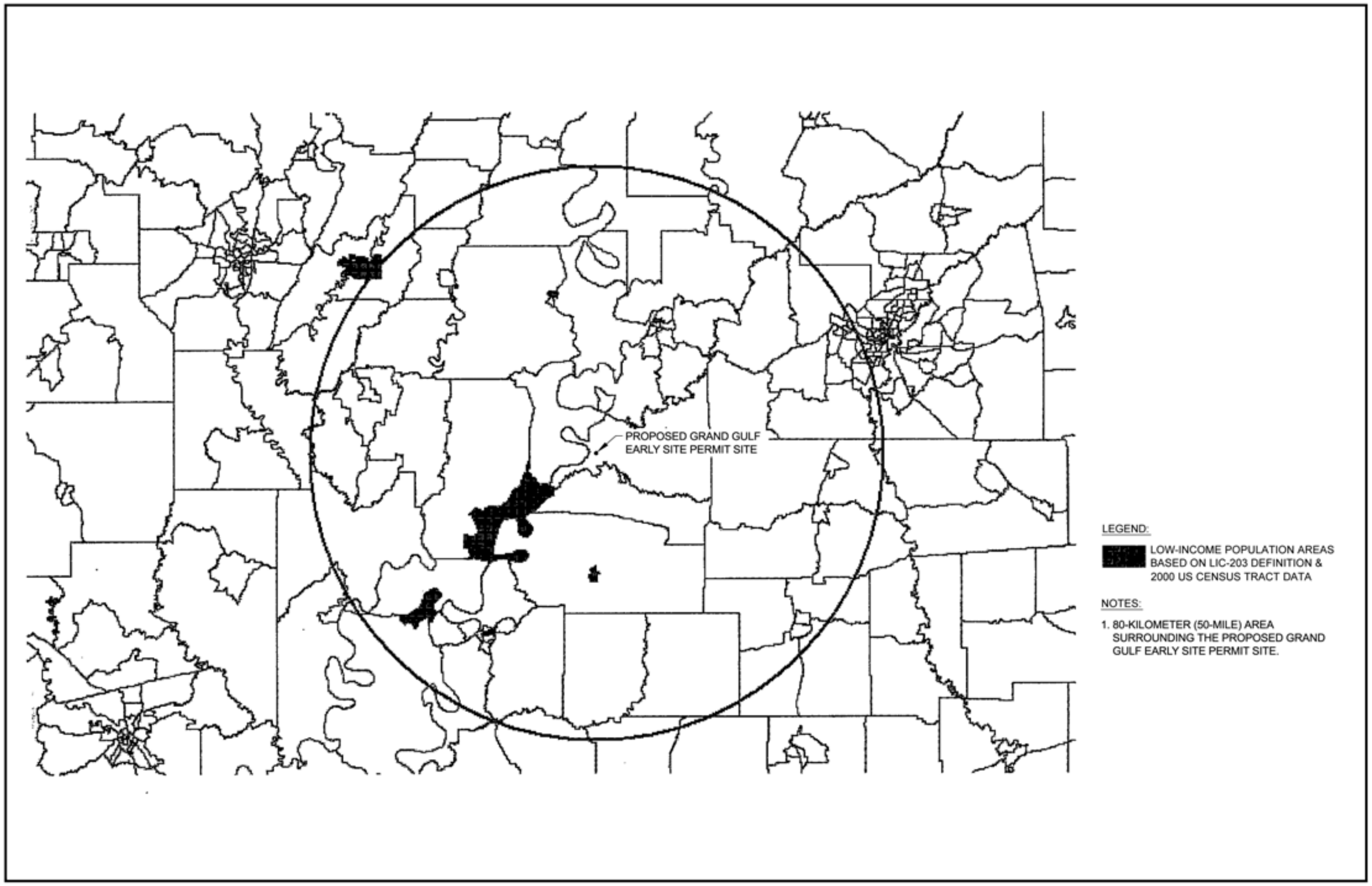

Figure 2-13. Low-Income Populations within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site (adapted from SERI 2005, Figures 2.5-8, 2.5-9)

very low numbers of white births (9) and infant deaths (3), although the derived white death rates are considerably higher than in the state or the nation. However, a major risk factor for death for infants is low birth weight, which can be related to poverty (and often, teen pregnancy), but is not usually related to environmental emissions. Out of 142 births in 2003, Claiborne County had 28 illegitimate teen births and 12 immature births (infant less than 2500 grams). The statistics on overall causes of death in the population show rates similar to those in Mississippi and the nation, with slightly lower overall local rates for Blacks/African Americans than for the population as a whole. Although the number of deaths in the County is small and casts doubt on the statistical significance of the derived rates by cause, the county heart disease and cancer death rates for Blacks/African Americans are below corresponding state and national rates and also are below those for whites in the county. The local black rate of death due to stroke is near the national black rate, which is significantly higher than the rate for the white population. In the county, the white rate (representing 3 individuals) is above that for blacks (7 individuals). The 10 accidental deaths in the county in 2003 yielded accidental death rates considerably above state and national rates. There were only 7 deaths due to chronic lung disease in the county, with derived white rates higher than those for the Black/African American population. Overall, based on death statistics, there is not any evidence that the Black/American population in Claiborne County is less healthy than the local white population, the population of the state, or that of the nation. In particular, there is no evidence in the health statistics of environmental conditions that make the Black/African American population exceptionally vulnerable.

Data were also gathered on subsistence hunting and fishing practices. There are no known studies of exceptional levels of hunting and fishing activity among minority and low-income individuals that directly relate to the nearest counties and to the Mississippi River. There is one study that was published in 1996 that attempted to identify, describe, and classify sport and subsistence fishing associated with rivers in the Delta region of Mississippi and to identify, describe, and classify how fish caught from rivers are used in Delta communities (Brown et al. 1996). The study collected responses on fishing from a stratified random sample of households in Charleston and Marks, Mississippi and a 16-km (10-mi) radius around each town. Activity centered mainly on the Yazoo and Tallahatchie Rivers. About 124 (37 percent) of the 336 respondents had fished in the previous year. Of these, 34 (27 percent) were white males, 22 (18 percent) were white females, 16 (13 percent) were black males, and 43 (35 percent) were black females. Twenty-eight (22.5 percent) of the active fishing population stated a preference to fish rivers. Both the survey and qualitative data showed local rivers are primarily the province of white commercial fishers and catfishers. Other groups tended to use ponds and lakes. Primary fish sought (roughly in order of preference) by both groups were catfish, crappie (*Pomoxis* sp.), bass, and bream. Bream were more popular among blacks than whites and bass more popular among whites than blacks. Whites were somewhat more likely than blacks to use boats (and bass preference was strongly associated with boat fishing), but over 70 percent of both groups fished from the bank. Both whites and blacks tended to keep their

Table 2-19. Selected Health Statistics for Minority and Total Population in Claiborne County, Mississippi, and United States

	Claiborne County (2003)[a]		Mississippi (2003)		United States (2002)	
	Total Population	**Black/African-American Population**[b]	**Total Population**	**Black/African-American Population**	**Total Population**	**Black/African-American Population**
Age-Adjusted Cancer Deaths (rate per 100,000 population)						
Male (For county, both sexes)	182.6	173.1	303.8	371	247.5	339.4
Female	Note: County Rates Not Available by Sex		169.5	192.4	165.5	194.3
Infant Mortality (rate per 1,000 live births)						
All Causes	21.1	22.6	10.3	14.8	7	14.4
Selected Leading Causes of Death (age adjusted rates per 100,000 population)						
All Causes	900	810	980	830	845.3	1083.3
Diseases of Heart	304.3	244.3	300.6	244.2	240.8	308.4
Malignant Neoplasms	182.6	173.1	205.6	171.6	193.5	238.8
Cerebrovascular Diseases	86.9	71.3	59.8	54.8	56.2	76.3
Emphysema and Chronic Lower Respiratory Diseases	60.8	50.9	48.1	18.2	43.5	31.2
Accidents	86.9	81.4	57.2	44.7	36.9	36.9

(a) There were 142 total births to Claiborne County residents in 2003, 9 white and 133 non-white. There were no white infant deaths and 3 non-white. Thus, rates are unreliable for the county due to small sample size.
(b) County rates are for the "non-white" population. In the case of Claibome County, the non-white population is overwhelmingly Black/African-American.
Sources: Kochanek et al. 2004; MDH 2005a, 2005b

catch for later consumption. Blacks were slightly more likely to eat their catch themselves the same day it was caught, give the fish away to relatives, sell or swap fish, or bring the fish to “fish fry” social events, while whites were more likely to freeze their catch for later consumption.

2.11 Related Federal Projects

The staff reviewed the possibility that activities of other Federal agencies might affect the granting of an ESP to SERI. Any such activities could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)).

After reviewing the Federal activities in the vicinity of the Grand Gulf ESP site, the staff determined that there were no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparation of this EIS. Future Federal actions related to this project include permits and licenses that may be required at the time of a CP or COL application. Other Federal actions may be required at the CP or COL stage, such as transmission-related studies by FERC. However, these activities have not been started and will be evaluated at the CP or COL stage. In summary, no other Federal activities or projects are associated with the ESP application.

This review identifies any related Federal activities that may, by granting the ESP, contribute to potential cumulative effects within the site, vicinity, or region. In the case of the proposed Grand Gulf ESP, an additional nuclear facility at the GGNS site would create a situation where the potential for cumulative effects might increase when considering the overlap of the affected regions of the ESP facility, GGNS Unit 1, and River Bend Nuclear Station. As such, the 80-km (50-mi) region around the ESP site would encompass portions of Adams, Amite, Franklin, and Wilkinson counties in Mississippi, and Concordia Parish in Louisiana. These areas would be within the 80-km (50-mi) region of 3 nuclear power stations if a new nuclear facility was constructed at the Grand Gulf ESP site. Similar overlaps of regions exist at the alternative sites considered. No other related Federal activities or cooperating agencies that affect facility siting or water supply have been identified.

2.12 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.”

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, “Domestic Licensing of Production and Utilization Facilities,” Appendix I, “Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion ‘As Low As is Reasonably Achievable’ for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents.”

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 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, “Reactor Site Criteria.”

18 CFR Part 35. Code of Federal Regulations, Title 18, *Conservation of Power and Water Resources*, Part 35, "Filing of Rate Schedules and Tariffs," Section 28(f), "Standardization of Generator Interconnection Agreements and Procedures."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

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3.0 Site Layout and Plant Parameter Envelope

The proposed Grand Gulf early site permit (ESP) site is located within the current boundaries of the Grand Gulf site, which contains Grand Gulf Nuclear Station (GGNS), Unit 1. As noted in Chapter 1, System Energy Resources, Inc. (SERI) did not define a particular reactor design and facilities layout in its ESP application. Instead, SERI used a plant parameter envelope (PPE) to provide bounds for assessing the environmental impact and determining site suitability. SERI's application (SERI 2005a) encompasses construction and operation of one or more new nuclear units generating as much as 8600 MW(t) or 3000 MW(e) output. The site layout and existing facilities are discussed in Section 3.1. The PPE itself is presented in Appendix I and discussed in Section 3.2. The electrical transmission system is discussed in Section 3.3.

3.1 External Appearance and Site Layout

The Grand Gulf ESP site, which lies within the 850-ha (2100-ac) confines of the Grand Gulf site, is situated on the eastern shore of the Mississippi River (Figure 2-1). The existing reactor unit at the GGNS (Unit 1) is a boiling-water reactor that went online in 1985. The reactor unit generates 3898 MW(t) or 1353 MW(e). It is cooled by a natural draft cooling tower and auxiliary mechanical draft tower located to the southwest of the containment and powerblock buildings. Makeup water for the cooling system is brought from radial wells along the Mississippi River via underground pipeline; discharge water is also piped to the Mississippi River via underground pipeline. The switchyard, which was originally constructed to support power from two units, lies to the east of the containment and powerblock buildings.

Originally, the Grand Gulf site was licensed by the Nuclear Regulatory Commission (NRC) for the construction of two units, although only one unit was completed and is currently operating. A portion of the containment building for Unit 2 was built before that unit was abandoned. This structure is located north of Unit 1. An area adjacent to Unit 1 was cleared and excavated for construction of a cooling tower for Unit 2, but it also was abandoned. These features are visible in the aerial view of the facilities shown in Figure 3-1, which also shows the main features of the GGNS facilities and the pipeline route to the Mississippi River. The existing facilities and structures of the GGNS facility cover 68 ha (169 ac) of the Grand Gulf site (SERI 2005a). The Grand Gulf ESP site, much of which has been disturbed previously, is located outside the area occupied by the existing GGNS facility and its support structures.

Figure 3-1. Aerial Photo of the Grand Gulf Nuclear Station

3.2 Plant Parameter Envelope

| As described in Subpart A of Title 10 of the Code of Federal Regulations (CFR) Part 52
| (10 CFR 52.17), the applicant for an ESP need not provide a detailed design of a reactor or reactors and the associated facilities, but must provide sufficient bounding parameters and

characteristics of the reactor or reactors and the associated facilities so that an assessment of site suitability can be made. Consequently, the ESP application may refer to a PPE as a surrogate for a nuclear power unit or units and associated facilities.

A 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. The PPE values are a surrogate for actual reactor design information. Analysis of environmental impacts based on a PPE approach permits an ESP applicant to defer the selection of a reactor design until the construction permit (CP) or combined construction permit and operating license (combined license or COL) stage. The PPE reflects upper or lower bounds of the values for each parameter that it encompasses rather than the characteristics of any specific reactor design. Appendix I lists the complete PPE values that are provided in the SERI ESP application.

Reactor Designs Considered in the PPE

In its ESP application, SERI used a composite of values from seven reactor designs to develop the bounds of its PPE (SERI 2005a). The values in this EIS are not design-specific. Rather, they are used to determine the environmental impact of any reactor design that falls within the bounding values used in this environmental impact statement (EIS). These reactor designs include the following five light water reactor and two gas-cooled reactor types:

- Advanced Canada Deuterium Uranium Reactor (ACR-700) – This reactor, developed by Atomic Energy Canada Limited, is an evolutionary extension of the CANDU 6 plant using very slightly enriched uranium fuel and light water coolant.

- Advanced Boiling Water Reactor (ABWR) – This reactor, developed by General Electric Company, is a standardized plant that has been certified under U.S. Nuclear Regulatory Commission (NRC) requirements (10 CFR Part 52, Appendix A). The ABWR is fueled with slightly enriched uranium and uses a light water cooling system.

- Advanced Pressurized Water Reactor (AP1000) – This is an earlier version of the AP1000 reactor final design developed by Westinghouse Electric Company and under review by the NRC, using slightly enriched uranium and a light water cooling system. This design is not the AP1000 that has been certified under U.S. Nuclear Regulatory Commission (NRC) requirements (10 CFR Part 52, Appendix A); therefore, this design will be referred to as the “surrogate AP1000.”

- Economic Simplified Boiling Water Reactor (ESBWR) – This reactor, developed by General Electric Company, is fueled with slightly enriched uranium and uses a light water cooling system.

- International Reactor Innovative and Secure (IRIS) next-generation pressurized water reactor (PWR) – This reactor, under development by a consortium led by Westinghouse Electric Company, is a modular light water reactor.

- Gas Turbine Modular Helium Reactor (GT-MHR) – This reactor, developed by General Atomics, is a modular helium-cooled graphite-moderated reactor.

- Pebble Bed Modular Reactor (PBMR) – This reactor, developed by PBMR (Pty) Ltd., is a modular graphite-moderated helium-cooled gas turbine reactor.

The ABWR and AP1000 designs have been certified by the NRC in accordance with 10 CFR Part 52, Subpart B. The other designs are in the pre-application stage.

SERI (or another applicant) would not be required to use any of these designs if it chooses to submit a CP or COL application, but the characteristics of the reactor ultimately chosen would have to be demonstrated to be within the bounds of the PPE for the assessment contained in this EIS to be applicable.

Review Approach

NUREG-1555, *Environmental Standard Review Plan* (ESRP) (NRC 2000), and review standard RS-002, *Processing Applications for Early Site Permits* (NRC 2004), provide guidance to the NRC staff to help ensure a thorough, consistent, and disciplined review of any ESP application. The staff’s June 23, 2003 response to comments received on draft RS-002 (NRC 2003) provide additional insights on the staff’s expectations and approach to the review of an application employing the PPE approach.

Because PPE values were used as a surrogate for design-specific values, the staff expected SERI to provide sufficient information for the staff to develop a reasonable independent assessment of potential impacts to specific environmental resources. In some cases, the design-specific information called for in the ESRP were not provided in the SERI ESP application because it did not exist or was not available. Therefore, the NRC staff could not apply the ESRP guidance in those review areas. In those cases, the NRC staff used its experience and judgment to adapt the review guidance in the ESRP and to develop assumptions necessary to evaluate impacts to certain environmental resources to account for this missing information. These assumptions are discussed in the appropriate sections of this EIS.

Because the SERI PPE values do not reflect a specific design, they were not reviewed by the NRC staff for correctness. However, the NRC staff made a determination that the application was sufficient to enable the staff to conduct its required environmental review and that the PPE values are not unreasonable for consideration by the staff when making its finding on the application in accordance with 10 CFR 52.18. During its environmental review, the staff used its judgment to determine whether SERI provided sufficient information for the staff to perform its independent assessment of the environmental impacts of construction and operation of a new nuclear unit or units. The staff considered the PPE values to be bounding parameters. Therefore, the staff's evaluation serves as a bounding estimate of the potential environmental impacts resulting from constructing and operating one or more new nuclear units at the ESP site.

Throughout the Grand Gulf ESP environmental report, SERI (2005a) provides:

(1) Commitments to address certain issues in the design, construction, and operation of the facility

(2) Statements of planned compliance with current laws, regulations, and requirements

(3) Commitments to future activities and actions that it will take should it decide to apply for a CP or COL

(4) Descriptions of SERI's estimate of the environmental impacts resulting from the construction and operation of a new nuclear unit or units on the Grand Gulf ESP site

(5) Descriptions of SERI's estimates of future activities and actions of others and the likely environmental impacts of those activities and actions that would be expected should SERI decide to apply for a CP or COL.

The activities described include, but are not limited to, such actions as:

- Considering the results of testing and monitoring during the development of a CP or COL application

- Complying with NRC and other agency regulations, including obtaining appropriate permits from other agencies

- Taking actions to mitigate adverse environmental impacts, including following industry or company standards, practices, or protocols

- Addressing certain issues at the CP or COL stage that were not addressed in the ESP application.

Some of these future actions are those that SERI would be required to implement because they are currently required by law, and others are actions that SERI has indicated that they would implement without the legal obligation to take such actions. Those matters considered by the staff in determining the level of impacts to a resource are discussed throughout this EIS and are listed in Appendix J.[(a)]

The staff performed its evaluation of the impacts of constructing and operating one or more new nuclear units at the ESP site assuming that these commitments, activities, and actions would be undertaken by SERI and others during future licensing activities.[(b)] As discussed previously, the staff developed assumptions necessary to evaluate impacts to certain environmental resources to account for missing detailed information. In addition to other sources of information obtained independently, the staff considered the commitments, future activities and actions, and estimates of expected environmental impacts that were identified by SERI in its environmental report and listed in Appendix J, as well as the PPE values listed in Appendix I, when developing the inputs and assumptions used in the NRC staff's independent review of the environmental impacts of constructing and operating one or more new units on the Grand Gulf ESP site.

In addition, as a result of the staff's environmental review of the SERI ESP application, the staff determined that conditions or limitations on the ESP may be necessary in specific areas, as set forth in 10 CFR 52.24. Therefore, the staff identified when and how assumptions and bounding values limit its conclusions on the environmental impacts to a particular resource, where appropriate.

During the review of a CP or COL application referencing an ESP, the staff would assess the environmental impacts of the construction and operation of a specific plant design. If the environmental impacts addressed in the ESP EIS are found to be bounding by the staff, no additional analysis of these impacts would be required, even if the ESP applicant employed the PPE approach. However, environmental impacts not considered or not bounded at the ESP stage would be assessed at the CP or COL stage. The inputs and assumptions that were used or considered during the staff's evaluation of the ESP application (listed in Appendixes I and J) would provide the basis for the staff's verification review in which the staff must determine whether or not a specific design in a CP or COL application falls within the PPE.

(a) The listing is not intended to be a complete list of the commitments described in the environmental report.

(b) Necessary commitments, activities, and actions may change over time as new laws are enacted and regulations are issued.

3.2.1 Facility Water Use

Raw water would be needed to support construction and operation of the Grand Gulf ESP facility. The installation of an additional well would likely be required for construction purposes, such as concrete batch facility operation, dust suppression, and sanitary needs. The normal heat sink (NHS), service water system (SWS), and ultimate heat sink (UHS) have operational water needs, that would be met using raw water withdrawn from the Mississippi River. Other water sources, such as wells, may be used to supply water for general site purposes including potable, sanitary, and landscape maintenance.

In the PPE (see Appendix I), SERI specified average and maximum raw water makeup for the Grand Gulf ESP facility. The PPE provides bounding constraints on portions of facility water use. Other constraints on facility water use are based on site-specific information. This EIS assesses the impact of facility water use bounded by the PPE and site-specific constraints. The following sections describe the water uses of the Grand Gulf ESP facility and the associated facility water treatment systems. The cooling systems are described in more detail in Section 3.2.2.

3.2.1.1 Facility Water Consumption

The dominant water use is makeup water for the NHS. That makeup water replaces water lost by evaporation, drift, and blowdown. The PPE (see Appendix I) lists the average makeup water flow as 3020 L/s (47,900 gpm) and the maximum makeup water flow as 4920 L/s (78,000 gpm). Average and maximum blowdown are listed as 807 L/s (12,800 gpm) and 2500 L/s (39,000 gpm). SERI proposes to discharge the NHS blowdown to the Mississippi River. The SWS water obtained from the Mississippi River would be routed to the NHS system for reuse, and the flows are therefore bounded by the flows identified for the NHS. The UHS would supply cooling water to safely shut down and cool down the facility in the event of an emergency. SERI's proposed UHS design is an engineered water basin with mechanical draft cooling towers. During emergency conditions, the UHS would draw water from that water basin and there would not be a demand for water from the local environment.

3.2.1.2 Facility Water Treatment

SERI discusses facility water treatment in Section 3.3.2 of the environmental report (SERI 2005a). The water supply system would provide water for the circulating water system, NHS, SWS, UHS, demineralized water system, fire protection system, and other miscellaneous raw water supply needs. The sources of water for the Grand Gulf ESP facility would be a new well in the Catahoula aquifer and a new intake on the Mississippi River. Filtration equipment, such as clarifiers, would remove suspended solids from the river water. Clarified, filtered, and chemically treated water would be required. The specific methods and chemicals required for the prevention of corrosion, biological fouling, and for process-water treatment are not known at this time. Discharge of chemical effluents from water treatment processes would be limited by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Mississippi Department of Environmental Quality (MDEQ).

3.2.2 Cooling System

The Grand Gulf ESP facility would have several different cooling systems. The largest heat load would be dissipated by the NHS. The SWS would have a far smaller heat rejection load, and the UHS designed heat rejection load is only required to safely shut down the facility. SERI has not yet finalized a detailed design for the cooling water systems. However, based on the location of the proposed site, SERI has considered the potential for three cooling system designs for the NHS: mechanical draft, natural draft, and a wet-dry hybrid design. While it can be expected that a wet-dry hybrid system would have lower water demands than a natural draft or mechanical draft tower, wet-dry hybrid towers were not included in the PPE (Appendix I) and were not considered further in the staff's review. The staff's discussion of the various heat-dissipation alternatives at the Grand Gulf ESP site is provided in Section 8.3.1 of this EIS.

3.2.2.1 Description and Operational Modes

Waste heat is a by-product of power generation at a nuclear power plant. The NHS is an integral part of such power generation. The NHS comprises a closed-loop circulating water system, pumps, water basin, and cooling towers. The circulating water system pumps water through the main condenser and then to the cooling towers. Heat is transferred to the water in the condenser and is dissipated to the atmosphere by evaporation. The main condenser for each unit of a new facility would reject heat to the atmosphere at a rate of 3140 MW(t) (10.7×10^9 Btu/hr) during normal full-power operation, according to the PPE (see Appendix I).

During the heat-dissipation process, evaporation of water increases the dissolved solids in the NHS cooling water. To limit the concentration of solids in the NHS cooling water, a portion of the water is discharged from the NHS system as blowdown. In addition to the blowdown and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling towers. SERI states that water pumped from the Mississippi River would be used to replace water lost by evaporation, drift, and blowdown. Blowdown water would be returned to the Mississippi River via a new outfall, thereby dissipating a small portion of the rejected heat to the Mississippi River. In the PPE (see Appendix I), SERI provides bounding values for water and energy fluxes for the NHS. The NHS values follow:

- Maximum blowdown flow would be 2500 L/s (39,000 gpm).
- Maximum blowdown temperature would be 38°C (100°F).

- Maximum evaporation rate would be 2500 L/s (39,000 gpm).
- Maximum makeup flow value would be 5000 L/s (78,000 gpm).

According to SERI, the SWS represents less than 1 percent of the NHS heat rejection load and is included in the NHS bounding values in the PPE.

SERI (2005a) proposes a closed-loop UHS for the Grand Gulf ESP facility. The UHS system would comprise pumps, heat exchangers, a dedicated water basin, and cooling towers. The basin would be required to maintain an adequate supply of water for 30 days of emergency operation. The UHS supplies the cooling water to structures, systems, and components required to safely shut down and cool down the nuclear power plant under normal operations, anticipated operational occurrences, and accident conditions. SERI (2005a) has provided bounding values for water and energy fluxes for the UHS. The UHS values follow:

- Maximum blowdown flow would be 110 L/s (1700 gpm).
- Maximum blowdown temperature would be 35°C (95°F).
- Maximum evaporation rate would be 110 L/s (1700 gpm).

According to these values, the UHS represents less than 1 percent of the NHS heat rejection load.

3.2.2.2 Component Descriptions

The following sections describe the intake, discharge, and heat-dissipation systems.

Intake System

SERI (2005a) states that water would be withdrawn from the Mississippi River through a proposed intake structure on the river shore, at or near the GGNS barge slip location. Water would be withdrawn from an embayment via piping connected to pumps and equipment housed in an intake pumping station in the vicinity of the embayment. Dredging would be required to form the embayment. The environmental report (SERI 2005a) shows the location of proposed intake, suction pipelines, and intake screens. To minimize erosion by river currents and to protect the integrity of the embayment, the slopes would be covered by riprap or other similar means. Screens would be mounted at the entrance to each suction pipeline to minimize uptake of aquatic biota and river debris. The intake screens would be designed so that the average velocity at the screens would be less than 0.15 m/s (0.5 ft/s), as required by 40 CFR 125.84, to limit organism mortality from impingement and entrainment. SERI would design the embayment to limit the amount and rate of sediment deposition and littoral debris carried into the embayment.

Discharge System

Effluent from the Grand Gulf ESP facility (including blowdown, excess service water, sanitary waste, filter process waste, radwaste effluent, and miscellaneous drain effluent) would be combined with the existing discharges from GGNS Unit 1 facility downstream from the embayment and intake. SERI (2005a) states that an outfall diffuser, located on the shoreline, would be used to enhance distribution and cooling of the effluent, thereby limiting thermal impact in the area of the discharge. SERI (2005a) states that the effluent discharge outfall would be located approximately 150 to 180 m (500 to 600 ft) downstream of the intake screens, and at approximately 9 m (30 ft) above the low water reference plane for the Mississippi River. The maximum discharge from all sources would be 2630 L/s (41,700 gpm). The NHS cooling tower blowdown would be the major contributor to the total discharge flow, and its return temperature is estimated at 38°C (100°F).

Heat Dissipation Systems

Heat dissipation from the NHS, SWS, and UHS would occur through the use of cooling towers and blowdown to the Mississippi River. Wet cooling towers were proposed by SERI (2005a) for the NHS and UHS. The SWS heat dissipation was incorporated into the NHS. Two different options for NHS cooling towers were evaluated for the Grand Gulf ESP facility. The first consisted of four natural draft cooling towers and the second used four 20-cell linear mechanical draft cooling towers. In both cases, the total heat rejection rate and the bounding values of blowdown flow rate and blowdown water temperature are defined in the PPE (Appendix I).

3.2.3 Radioactive Waste Management System

Liquid, gaseous, and solid radioactive waste management systems would be used to collect and treat the radioactive materials that are produced as a by-product of operating the proposed unit or units on the Grand Gulf ESP site. These systems would process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and to levels as low as is reasonably achievable (ALARA) before being released to the environment. Waste processing systems would be designed to meet the design objectives of 10 CFR Part 50, Appendix I (*Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents*). Radioactive material in the reactor coolant would be the primary source of gaseous, liquid, and solid radioactive wastes in light water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products would be contained in the sealed fuel rods, but small quantities escape the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system would also be responsible for coolant contamination.

The SERI ESP application did not identify specific radioactive waste management systems for new facilities constructed at the Grand Gulf ESP site. The PPE concept was used to provide an upper bound on liquid radioactive effluents, gaseous radioactive effluents, and solid radioactive waste releases (SERI 2005a). For liquid releases, a composite release from the following reactors was used to bound the releases: two ABWR units, two surrogate AP1000 units, and four ACR-700 units. With regard to gaseous releases, the bounding releases were determined using two ABWR units, two surrogate AP1000 units, eight GT-MHR modules, four ACR-700 units, and six IRIS units (SERI 2005b). Bounding gaseous effluent releases are found in Table 3.0-7 of the Grand Gulf ESP environmental report (SERI 2005a). Bounding liquid effluent releases are found in Table 3.0-8 of the environmental report (SERI 2005a).

The bounding total annual volume of solid radioactive waste is estimated at 540 m^3/yr (1.9×10^4 ft^3/yr) with a bounding total amount of radioactive material of 2×10^{14} Bq/yr (5400 Ci/yr) as found in the PPE (SERI 2005a).

3.2.4 Nonradioactive Waste Management

SERI has not finalized design of nonradioactive waste management systems yet. These systems include cooling water and auxiliary boiler blowdown that may contain water-treatment chemicals or biocides, water-treatment wastes, floor and equipment drain effluent, storm water runoff, laboratory waste, trash, hazardous waste, effluent from the sanitary sewer system, miscellaneous gaseous emissions, and liquid and solid effluent. Nonradioactive liquid waste effluents would be regulated under the NPDES permit process and would require a permit from the MDEQ.

3.2.4.1 Effluents Containing Chemicals or Biocides

Chemicals are typically used to control water quality, scale, corrosion, and biological fouling. The chemical concentrations within effluent streams from a new facility would be controlled through engineering, operational, and administrative controls in order to meet NPDES requirements at the time of construction and operation.

3.2.4.2 Sanitary System Effluents

SERI (2005a) states that a permanent sanitary waste system would be provided for the operational phase of the Grand Gulf ESP facility. Industrial materials, such as chemistry laboratory waste, would be excluded from the sanitary waste system. The chosen sanitary waste system design would incorporate state-of-the-art sewage treatment and disposal technologies to treat domestic waste only and it would comply with future expected NPDES permit requirements.

3.2.4.3 Other Effluents

Nonradioactive gaseous emission results from operating auxiliary boilers and from testing and operating the standby power system, which may use diesel and/or gas turbine generators. These emissions commonly include particulates, sulfur oxides, carbon monoxide, hydrocarbons and nitrogen oxides. Gaseous releases would comply with Federal, State, and local emissions standards.

Chemical waste from laboratory drains, equipment decontamination, and chemical additives would be collected in chemical waste sumps or approved chemical storage units. Chemical drainage system waste would be monitored, treated, and released in accordance with an approved NPDES permit, or otherwise disposed. Discharges from the chemical drainage system would comply with applicable Federal, State, and local standards in place during operation of a new facility. Hazardous nonradioactive waste would be treated and disposed of in accordance with all applicable Federal, State, and local regulations.

Storm water from structures constructed at the Grand Gulf ESP site would typically flow into major drainage courses and finally to Hamilton Lake, which is hydraulically connected to the Mississippi River. The design of the storm water systems for a new facility would comply with NPDES storm water regulations administered by MDEQ.

Other nonradioactive waste (such as paper, metals, and garbage) would be disposed in accordance with applicable regulations. Nonradioactive effluent would be treated, controlled, and discharged or disposed as required to meet Federal, State, and local regulations and guidelines.

3.3 Transmission System

| The ESP site is adjacent to the GGNS Unit 1 facility and wholly contained within the property
| boundary of the Grand Gulf site. The Grand Gulf site is linked to load centers by a system of transmission lines in the Entergy Mississippi, Inc. (EMI) electric system. The EMI electric system consists of interconnected hydro, fossil-fuel, and nuclear power plants that supply electrical energy over a 500/230/115 kV transmission system. EMI owns the GGNS switchyard where the GGNS Unit 1 facility is connected to two transmission lines. The two lines are the

| • 40.3-km (25.2-mi) long, single-circuit 500-kV line that connects to the Baxter-Wilson Extra High Voltage Substation

| • 69.8-km (43.6-mi) long, single-circuit 500-kV line that connects to the Franklin Extra High Voltage Substation.

In addition to the length, the power transmission line right-of-way widths and areas of these transmission lines are listed in Table 3-1. Electrical energy from GGNS Unit 1 is transmitted by the 500-kV lines, which existed when the GGNS Unit 1 facility was built (SERI 2005a). A separate distribution line (single-circuit 115 kV) runs from the Port Gibson substation to the GGNS switchyard to provide offsite power to GGNS. The staff assumes that this line would be sufficient to service any new units at the ESP site without modification. Therefore, this line and its right-of-way are not considered further.

Table 3-1. Existing Transmission Line Rights-of-Way to the Grand Gulf Site

Right-of-Way	Voltage	Length km (mi)	Average Width m (ft)	Area ha (ac)
Baxter-Wilson	500 kV	40.3 (25.2)	61 (200)	248 (612)
Franklin	500 kV	69.8 (43.6)	61 (200)	428 (1057)
Total		**110.7 (68.8)**		**675 (1669)**[(a)]

(a) Difference from 1575 in SERI environmental report (2005) due to rounding.
Source: SERI 2005a

SERI (2005a) states that the power transmission and distribution system existing at the time of startup and operation of a new facility would be relied upon to distribute the power generated by the facility. A study of the existing system conducted by SERI concluded that the existing system is adequate for an additional 1311 MW(e) generating capacity assuming that modifications and upgrades are made to equipment in the GGNS switchyard (SERI 2005a).

SERI (2005a) states that the maximum generating capacity of the proposed new units is approximately 3000 MW(e). If 3000 MW(e) generating capacity were installed, the existing transmission lines would have to be upgraded or additional transmission lines would be required. Assuming that a new facility at the Grand Gulf ESP site would be a merchant generator, procedures for requesting connection to the transmission system are set forth in the Federal Energy Regulatory Commission standard interconnection procedures and agreement called out in 18 CFR 35.28(f), “Standard Generator Interconnection Procedures and Agreement,” as described below.

The Federal Energy Regulatory Commission process starts when the interconnection customer, in this case SERI, submits an interconnection request to EMI, the transmission provider. When the interconnection request is determined to be valid, the transmission provider and interconnection customer have a scoping meeting to discuss alternative interconnection options and exchange information. On the basis of this meeting, the interconnection customer designates its point of interconnection, and one or more alternative point(s) of interconnection.

Following the scoping meeting, the transmission provider conducts an interconnection feasibility study to evaluate the feasibility of the proposed interconnection to the transmission system. This study includes a power flow and short circuit analysis. The interconnection feasibility study is followed by an interconnection system impact study that focuses on the impact of the interconnection on the reliability of the transmission system.

Finally, the transmission provider conducts an interconnection facilities study to specify and estimate the cost of the equipment, engineering, procurement, and construction work needed to implement the conclusions of the interconnection system impact study in accordance with good utility practice to physically and electrically connect the interconnection facility to the transmission system. These studies are conducted by the transmission provider, but the interconnection customer pays for the studies.

SERI has not submitted an interconnection request to EMI. However, the staff assumes that the process for obtaining any additional transmission services required would be completed prior to submission of an application for construction and operation of a new facility at the Grand Gulf ESP site. In addition, the staff assumes that the Grand Gulf ESP facility connection with the transmission system would be similar to the GGNS Unit 1 facility connection and would make use of existing transmission line rights-of-way to the extent possible. Additional land might be required, if only to widen existing rights-of-way. Land use in the existing transmission line rights-of-way is described in Table 3-2.

Table 3-2. Land Use in the Existing Transmission Line Rights-of-Way to the Grand Gulf Site

Right-of-Way	Agriculture	Developed Nonresidential	Residential	Undeveloped	Water or Wetlands
Baxter-Wilson	23.9%	0.4%	4.5%	62.8%	8.3%
Franklin	9.4%	0.0%	0.0%	86.3%	4.3%
Total	**14.7%**	**0.2%**	**1.7%**	**77.7%**	**5.8%**

Notes: U.S. Geological Survey land-cover classes have been aggregated for presentation purposes. Rounding may affect totals.
Source: Vogelmann et al. 2001

3.4 References

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

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."

18 CFR Part 35. Code of Federal Regulations, Title 18, *Conservation of Power and Water Resources*, Part 35, "Filing of Rate Schedules and Tariffs," Section 28(f), "Standard Generator Interconnection Procedures and Agreement."

40 CFR Part 125. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 125, "Criteria and Standards for the National Pollution Discharge Elimination System."

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4.0 Construction Impacts at the Proposed Site

This chapter examines the environmental issues associated with the potential construction of one or more additional nuclear power units at the proposed Grand Gulf early site permit (ESP) site as described in the application for an ESP submitted by System Energy Resources, Inc. (SERI). As part of this application, SERI submitted an environmental report (SERI 2005) that provides a plant parameter envelope (PPE) (see Appendix I) as the basis for the environmental review. Although certain site preparation activities are permitted by Title 10 of the Code of Federal Regulations (CFR) 52.25(a) under an ESP, SERI has chosen not to include a site redress plan in its application and, therefore, would not be permitted to undertake site preparation activities prior to obtaining a construction permit (CP) or combined license (COL) from the U.S. Nuclear Regulatory Commission (NRC), except as provided in 10 CFR 50.10(e).

Sections 4.1 through 4.9 of this chapter discuss potential impacts of construction on land use, air quality, water, ecosystems, socioeconomics, historic and cultural resources, and environmental justice, as well as nonradiological and radiological health effects. In accordance with 10 CFR Part 51, the impacts are analyzed and, where possible, a single significance level of potential impact – SMALL, MODERATE, or LARGE – is assigned to each analysis. Measures and controls to limit adverse impact are presented in Section 4.10. A summary of construction impacts is presented in Section 4.11. Section 4.12 lists the references cited in this chapter.

The staff relied on the mitigation measures and the required Federal, State, and local permits and authorizations presented in the SERI environmental report in reaching its conclusion on the significance level of the adverse impacts. The staff also relied on the infrastructure upgrades planned by the counties, cities, and towns, such as road and school expansions, in assigning significance levels to the impacts. The staff will verify the continued applicability of all assumptions used in this environmental impact statement, should an applicant for a CP or COL reference an ESP for the Grand Gulf ESP site.

4.1 Land-Use Impacts

This section provides information regarding land-use impacts associated with site preparation activities and construction of a new nuclear facility at the Grand Gulf ESP site. Topics discussed include land-use impacts at the site and in the vicinity of the site and land-use impacts in transmission line rights-of-way and offsite areas.

4.1.1 Site and Vicinity

Certain details of construction at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis is not to the depth warranted for actual construction. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

The Grand Gulf site encompasses approximately 850 ha (2100 ac). Figure 2-4 indicates the areas likely to be affected by ESP site preparation and construction activities. Construction of a new facility would result in some alterations of current land use. Much of the area for a new facility within the proposed construction area footprint was altered as a result of the construction and operation of the Grand Gulf Nuclear Station (GGNS).

An estimated 162 ha (400 ac) of the 850-ha (2100-ac) Grand Gulf site would be affected by construction of a new facility (SERI 2005). The principal impacts during site preparation and construction of a new nuclear reactor at the Grand Gulf ESP site would include clearing, dredging, grading, excavation, spoil deposition, and dewatering. Based on the information provided by SERI (2005) and in response to the staff's request for additional information (SERI 2004e), the staff estimates that approximately 30 percent, about 49 ha (120 ac), of the proposed construction footprint for the Grand Gulf ESP facility would affect areas of the site that were not previously affected during the GGNS construction. These land areas primarily consist of forested tracts left intact during the GGNS construction.

An estimated 51 ha (125 ac) would contain permanent structures (primarily a power block area, cooling tower area, and bottomland pipeline and intake areas) (SERI 2005). Acreage not containing permanent structures would be reclaimed to the maximum extent possible (SERI 2005).

Construction activities would be conducted within the Mississippi River floodplain. These include dredging at the existing barge slip area and proposed water intake structure and embayment, along with construction of other items that are part of that water intake facility. Additionally, trenching from the intake to the proposed power block on the bluffs east of the river would be required to lay supply and discharge piping from the Grand Gulf ESP facility. The water intake for the Grand Gulf ESP facility would be located at or near the existing barge slip area (SERI 2005). Dredging of the new intake areas would have some impact as the dredged material would most likely be deposited on the Grand Gulf ESP site. Excavation and construction of the intake structure along the river bank in the flood plain areas would have some impact on land use, but the impact is expected to be temporary.

The magnitude of the impact from local or onsite use of dredged material, construction, or other excavated spoils cannot be determined until a facility design is submitted at the CP or COL stage. Given the information provided in the applicant's environmental report and the staff's independent review, impacts on land use in the site and vicinity could be SMALL if the disposition of dredge spoils and the use of borrow are shown to be confined to the proposed ESP facility construction footprint, and best management practices are used in the management of affected areas. Land use impacts could be MODERATE if the disposition of dredge spoils and the use of borrow affect areas outside the proposed ESP facility construction footprint, or if best management practices are not followed in the management of these resources. An applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide additional information on the planned disposition of dredge spoils and the use of borrow in order for the staff to make a significance determination regarding the impacts of construction on land use at the site and vicinity.

In its response to a staff request for additional information, SERI (2004d) indicated that, although the restoration of rail service to the Grand Gulf ESP site was not evaluated for the ESP application, it could be reconsidered at the time of a CP or COL application. Based on statements by SERI in the environmental report (SERI 2005), the staff assumes that construction material would be barged to the site and trucked on the reconditioned heavy haul road, and that rail service would not be restored to the Grand Gulf ESP site.

If an applicant were to resume active rail service on the existing spur for construction activities at the Grand Gulf EIS site, the staff estimates that 29.2 km (18.2 mi) of abandoned railway would need to be evaluated to determine the level of restoration that would be necessary. The evaluation of railway restoration necessarily would require the participation of the railway owner, State and local officials, and the requester of rail service restoration. For example, no determination has been made to identify whether the existing spur line can be restored, or whether an entirely new rail line would be needed. Given the information provided in the applicant's environmental report, the staff's requests for additional information, and the staff's independent review, impacts on land use in the site and vicinity could be SMALL if minimal reconditioning of the abandoned rail spur would be needed to return the line to service for the ESP facility construction. Land use impacts could be MODERATE if the restoration of rail service to the ESP site would involve extensive reconditioning or construction of an entirely new rail line to transport construction materials to the ESP site. An applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide additional information on the full extent of any planned restoration of rail service to the ESP site in order for the staff to make a significance determination regarding the impacts on land use at the site and vicinity.

Based on its review, the staff concludes that additional information on (1) the planned disposition of dredge spoils and the use of borrow and (2) the full extent of any planned restoration of rail service to the ESP site is needed in order to determine the impacts associated with construction on land use at the site and vicinity. Therefore, the staff concludes that this issue is unresolved.

4.1.2 Transmission Line Rights-of-Way and Offsite Areas

Certain details of construction at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis is not to the depth warranted for actual construction. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

The transmission and distribution system existing at the GGNS at the time of startup and operation of the Grand Gulf ESP facility would be relied upon to distribute the power generated by a new ESP facility (SERI 2005). A study conducted by SERI concluded that the existing system would be adequate for at least an additional 1311 MW(e) generating capacity, assuming that modifications and upgrades are made to equipment in the switchyard of the GGNS Unit 1 facility (SERI 2005). However, the maximum generating capacity identified in the PPE is approximately 3000 MW(e) (SERI 2005). If 3000 MW(e) generating capacity is installed, the existing transmission lines would have to be upgraded or additional transmission lines would be needed.

If the Grand Gulf ESP facility is constructed, the actual need for and type of transmission system improvements would be determined definitively by the transmission and distribution system owner and operator (currently Entergy Mississippi, Inc.) under the provisions of 18 CFR Part 35. In general, the process is designed to determine the optimal routing of new transmission service by performing studies of feasibility, impact, and facilities associated with the transmission request. This process is discussed in Section 3.3 of this EIS. The staff assumed that once the transmission routing is determined, if required, State or local agencies governing the actual siting of transmission facilities would be consulted.

Upgrading the existing transmission line rights-of-way would be necessary to accomodate the full generating capacity of the proposed ESP facility. To accomplish this upgrade, one or more new rights-of-way could be needed, or all upgrades could be sited within the existing rights-of-way with no right-of-way expansion necessary. The addition of new support structures and transmission lines and vegetation clearing would be necessary for construction of new transmission lines on new or expanded rights-of-way. Based on values in Table 2-1, the staff estimated that the land-use impact of doubling the width of the current rights-of-way would include conversion of as much as 524 ha (1296 ac) of currently undeveloped forested land to vegetation-managed land along the widened portions of the rights-of-way. Although the existing rights-of-way traverse unzoned and largely undeveloped land and were impacted previously when the existing transmission lines were constructed, the actual route or routes for any upgrade involving new rights-of-way are unknown.

Land ownership in the vicinity of the existing transmission line rights-of-way include a mixture of public land and private land. About 14.4 km (9 mi) of the Franklin transmission line right-of-way traverses the Homochitto National Forest, which includes a mix of public and private land ownership (USFS 1989). SERI, the transmission line owner, and the U.S. Forest Service (USFS) would need to coordinate processes in order to follow the procedures the USFS requires to effect changes, upgrades, or other significant modifications to these transmission line rights-of-way.

Given the information provided in the applicant's environmental report and the staff's independent review, impacts on land use in the transmission line rights-of-way and offsite areas could be SMALL if the existing rights-of-way are determined to be the preferred routing of any new transmission lines that may be needed to deliver power from a proposed ESP facility. Land use impacts could be MODERATE if the preferred routing of any new transmission lines would convert significant tracts of previously undeveloped land not adjacent to the existing rights-of-way. An applicant for a CP or COL referencing any ESP that may be issued for the Grand Gulf ESP site would need to provide additional information on the precise routing of any planned transmission service needed to deliver power from the ESP facility for the staff to make a significance determination with respect to this resource.

Based on its review, the staff concludes that additional information on the precise routing of any planned transmission service needed to deliver power from a proposed ESP facility is needed in order to determine the construction impacts to offsite land use. Therefore, the staff concludes that the issue of offsite land use impacts associated with construction of a proposed ESP facility is unresolved.

4.2 Meteorological and Air Quality Impacts

Sections 2.3.1 and 2.3.2 describe the meteorological characteristics and air quality of the Grand Gulf ESP site. Dust from construction activities, smoke and other pollutants from open burning, emissions from equipment and machinery used in construction, concrete batch plant operations, and emissions from vehicles used to transport workers and materials to and from the site would be the primary impacts of construction of the Grand Gulf ESP facility on local meteorology and air quality.

4.2.1 Construction Activities

Activities associated with construction of the Grand Gulf ESP facility would be similar to the activities associated with construction of any large industrial complex. There will be ground-clearing, grading, excavation, and movement of materials and machinery.

Ground-clearing, grading, and excavation activities will raise dust, as will the movement of materials and machinery. Fugitive dust may also rise from cleared areas during windy periods. SERI has stated in its environmental report (SERI 2005) that dust from construction activities would be mitigated to the extent possible. Mitigation measures would include wetting of unpaved roads and construction areas during dry periods and seeding or mulching bare areas. The concrete batch plant would be equipped with a dust-control system that would be checked and maintained on a routine basis.

Construction equipment burning gasoline or diesel fuel would be inspected and maintained to prevent excessive exhaust emissions. SERI states (SERI 2005) that equipment that does not meet air quality regulations and permits in place at the time of construction would be repaired or replaced.

SERI stated (SERI 2005) that open burning would be conducted in a burn pit using technology to increase combustion efficiency and reduce smoke level in compliance with applicable air-permit requirements established by the Mississippi Department of Environmental Quality (MDEQ). Procedures would be established to prevent brush and forest fires initiated by open burning.

Construction activities take place for a limited duration. Any impacts on meteorology and air quality that might occur would be temporary. The staff concludes that the impacts of construction activities on air quality would be SMALL, based on mitigation identified in SERI's environmental report (SERI 2005).

4.2.2 Transportation

SERI estimates that the maximum construction workforce would be approximately 3150 workers (SERI 2005). Exhaust from the vehicles required to transport this workforce would decrease air quality somewhat, but it is unlikely that air quality would be degraded sufficiently to be noticeable beyond the immediate vicinity of Grand Gulf Road and State Highway 18 and U.S. Highway 61. Mitigation of potential air quality impacts of increased traffic could be achieved by arranging shift changes for construction workers so they do not coincide with shift changes for GGNS Unit 1 personnel.

The effects of vehicle exhaust from 2300 cars (4600 trips per day) were considered by the NRC in NUREG-1437 (NRC 1996) and found to be of potential concern if the trips were made in an area where air quality does not meet the National Ambient Air Quality Standards. Air quality in Mississippi and nearby counties in Louisiana is consistent with all Standards. Therefore, the staff concludes that the impact on air quality of increased traffic associated with construction of the Grand Gulf ESP facility would be SMALL, and additional mitigation would not be warranted.

4.3 Water-Related Impacts

Water-related impacts involved in the construction of a nuclear power plant are similar to impacts that would be associated with any large industrial construction project. Prior to issuance of a CP or COL, SERI would be required to obtain permits, certificates, and determinations regulating water use and water quality. These permits, certificates, and determinations may include:

- Clean Water Act Section 404 permit. This permit would be issued by the U.S. Army Corps of Engineers (ACE) and would regulate the impacts of construction activities on wetlands and management of dredged material.

- Clean Water Act Section 401 certification. This certification would be issued by MDEQ and would ensure that the project does not conflict with state water quality management programs.

- Clean Water Act Section 402(p) National Pollutant Discharge Elimination System (NPDES) storm water permit. This permit would be issued by MDEQ and would regulate point source storm water discharges. U.S. Environmental Protection Agency's Phase 1 Storm Water Regulation established requirements for storm water discharges from various activities including construction activities disturbing an area of at least 2.0 ha (5.0 ac). EPA has delegated the responsibility for administering the NPDES program in Mississippi to MDEQ.

- Section 10 of the Rivers and Harbors Act of 1899. This section prohibits the obstruction or alteration or the excavation or filling of navigable waters of the United States without a permit. Appropriate ACE permits would be obtained for construction in the floodplain.

- Section 1424(e) of the Safe Drinking Water Act of 1974. This section prohibits any commitment for federal financial assistance (through a grant, contract, loan guarantee, or otherwise) for any project which the EPA Administrator determines may contaminate an aquifer designated by the Administrator to be a sole-source aquifer. EPA has identified the Southern Hills Aquifer, which includes the Catahoula formation beneath the Grand Gulf site, to be a sole-source aquifer (EPA 1998).

4.3.1 Hydrological Alterations

The staff did not identify any significant changes to the local flow patterns or intensities that would occur at the site due to construction. The construction site drainage system would generally drain surface water runoff and storm flow in approximately the same levels to

Stream A and Stream B. Any increase in runoff intensity resulting from the increase in the impervious surface area would be mitigated using standard engineering storm water management practices pursuant to the site's NPDES storm water management program.

The construction of the shoreline intake and discharge structures along the Mississippi River would likely involve some temporary structures for protection from the flow of the river. However, these structures would not extend significantly into the river and would have minimal impact on the river's flow pattern adjacent to the shoreline.

Dewatering systems during construction would only impact the shallow aquifers. However, based on the character of the shallow groundwater system, staff concluded that any impacts on the groundwater flow pattern would be localized and any change would unlikely extend beyond the site boundary.

Based on the above, the staff concludes that the impact of hydrological alterations from construction would be SMALL, and additional mitigation would not be warranted.

4.3.2 Water-Use Impacts

Certain details of construction at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis is not to the depth warranted for actual construction. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

SERI stated (2005) that construction activities at the Grand Gulf ESP site would not be expected to use surface water. SERI stated that additional groundwater wells would be required for construction purposes such as concrete batch plant operation, dust suppression, and sanitary needs (SERI 2005). SERI also stated that the use of the additional wells installed in the Catahoula formation for construction water needs would not significantly affect the groundwater water surface elevation in the vicinity (SERI 2005). However, the staff concluded that the characterization of the Catahoula aquifer was inadequate to support such a conclusion, particularly given the significance of the aquifer for local domestic water supplies and its designation by EPA as a sole-source aquifer. Because of the limited number of borings into the Catahoula formation, limited hydraulic conductivity measurements, and limited long-term pump tests, the staff was unable to assess reliably the impact of a significant increase in the groundwater withdrawal at the site. Given the information provided in the applicant's environmental report and the staff's independent review, impacts on the Catahoula formation could be SMALL if the proposed withdrawal had little effect on the Catahoula formation or MODERATE if the proposed withdrawal were to adversely affect current water withdrawals elsewhere in the aquifer. An applicant for a CP or COL referencing an ESP for the Grand Gulf

ESP site would need to provide additional information on the ability of the Catahoula aquifer to sustain proposed withdrawals in order for the staff to make a significance determination with respect to this resource.

Dewatering at the new ESP power block excavation would likely be necessary during construction. Specific dewatering well locations and well design details would be determined when the detailed facility design and layout are finalized. Construction standards for temporary construction dewatering wells and for permanent dewatering wells would be in accordance with applicable standards published in the MDEQ groundwater use and protection regulations (MDEQ 1994), and necessary permits would be obtained from the MDEQ. MDEQ regulations allow for permit denial or reduction of withdrawal rate if such a withdrawal is expected to interfere with existing permitted uses or if it conflicts with the public interest. The staff concludes that the impact of construction dewatering would be small, temporary, and localized.

Based on its review, the staff concludes that additional aquifer characterization is needed to determine the impacts of additional groundwater withdrawals from the Catahoula formation for construction water needs. Therefore, the staff concludes that the issue of water-use impacts associated with the construction of a facility at the ESP site is unresolved.

4.3.3 Water-Quality Impacts

Certain details of construction activities at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis was not performed to the depth warranted for actual construction. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

Erosion of exposed and poorly graded soil during construction activities can result in a significant increase in the sediment load to nearby water bodies. Based on the location of the proposed facility, Stream A is most likely to represent a significant sediment concern. The ESP application (SERI 2005) proposed that the intake and discharge pipelines would follow the path of the existing haul roads for approximately 1.8 km (1.1 mi) to the uplands. Pipelines would also be required to cross Stream A to reach the proposed cooling tower area. This would either involve crossing Sediment Basin A or crossing upstream of Sediment Basin A adjacent to the existing roadway to the northern end of the ESP site. The excavations associated with these pipelines, as well as the reactor block(s) excavation and site grading for the cooling towers and other buildings, represent an opportunity for the region's frequent storms to mobilize a considerable amount of sediment into the streams. SERI would be regulated by a NPDES storm water permit issued by MDEQ to employ erosion-prevention practices such as vegetation buffers, temporary sedimentation basins, and silt fences within a storm water pollution prevention plan. The staff concludes that, because the lowlands environment naturally experiences high sediment loads during the annual flooding of the Mississippi River, current best management practices for storm water management would be adequate to ensure that the impacts on to water quality from the erosion of sediment would be small.

Federal financially assisted projects that have potential to contaminate a designated sole source aquifer are subject to EPA review. Federal financial assistance is defined as any financial benefits provided directly as aid to a project by a department, agency or instrumentality of the Federal government in any form, including contracts, grants, and loan guarantees. If Federal financial assistance is obtained, a CP or COL applicant would be required to obtain an EPA determination that construction (and operational) activities would not adversely impact the groundwater quality at the facility.

Dredging and shoreline construction would be needed to expand and deepen the shoreline embayment and to improve the barge slip or unloading facility. During these activities, turbidity in the Mississippi River would be expected to increase in the immediate vicinity. Dredging operations would be regulated by the ACE to protect navigation and habitat. SERI has committed to restrict shoreline construction of the intake and discharge structures to periods when river water level would be low to minimize the impacts to the river. Based on the above, and the large assimilative capacity of the Mississippi River, the staff concludes the impacts would be negligible.

Given the information provided in the applicant's environmental report and the staff's independent review, impacts on the Catahoula formation could be SMALL if the proposed withdrawal had little effect on the Catahoula formation or LARGE if the proposed withdrawal were to induce degradation of the water quality of the sole source aquifer. An applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide additional information on the ability of the Catahoula aquifer to sustain proposed withdrawals in order for the staff to make a significance determination with respect to this resource.

Based on its review, the staff concludes that additional aquifer characterization is needed to determine the impacts of additional groundwater withdrawals from the Catahoula formation for construction water needs. Therefore, the staff concludes that the issue of water-quality impacts associated with the construction of the proposed Grand Gulf ESP facility is unresolved.

4.4 Ecological Impacts

This section describes the potential impacts of construction on the ecological resources at the Grand Gulf site and along the transmission line rights-of-way. The section is divided into three subsections: Terrestrial Ecosystems, Aquatic Ecosystems, and Threatened and Endangered Species.

4.4.1 Terrestrial Ecosystems

The NRC staff evaluated the potential impacts to wildlife and their habitat from construction of the Grand Gulf ESP facility and potential expansion of the existing transmission line rights-of-way on terrestrial ecosystems.

Certain details of construction activities at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis was not performed to the depth warranted for actual construction. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

4.4.1.1 Wildlife Habitat on the Grand Gulf Site

The construction associated with GGNS Unit 1 and subsequent vegetation succession is relevant to the potential impact of construction on wildlife habitat at the Grand Gulf ESP site.

A total of 850 ha (2100 ac) is located within the Grand Gulf site boundary (NRC 1996; SERI 2005). The site was originally intended to contain two nuclear units. GGNS Unit 1 was completed and the second unit was only partially completed. Approximately 188 ha (465 ac) of the site were affected by construction of the existing GGNS Unit 1 facility and partial completion of Unit 2. Currently, developed land occupies a total of about 132 ha (325 ac) or about 15 percent of the total site area, about 110 ha (270 ac) in the uplands and 22 ha (55 ac) in the bottomlands (Figure 2-5). About half of this total consists of permanent structures and facilities (68 ha (169 ac)) (SERI 2005).

Of the total area disturbed by construction of the GGNS Unit 1 facility, the portions not currently occupied by permanent structures and facilities and those not artificially maintained in an herbaceous state (for example, via herbicide applications) have been allowed to revegetate naturally. In the 30 years since construction of GGNS Unit 1, these areas have largely become colonized by invasive weedy plant species and have not succeeded to hardwood forest communities (SERI 2005). Lack of hardwood forest succession in previously disturbed areas has also been documented from old fields in the uplands (presumably former grazing land) and bottomlands (presumably former crop land). According to SERI (2005), upland and bottomland old fields were succeeding to loblolly pine (*Pinus taeda*) and American sycamore (*Platanus occidentalis*) stands, respectively. However, in reality, hardwood forest succession was not taking place in these areas. Instead, Entergy Operations had replanted these forest stands (SERI 2005).

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Most of the footprint of the proposed Grand Gulf ESP facility consists of power block, cooling towers, new intake and discharge, pipelines, and associated equipment staging areas and borrow sites. However, the specific locations of many of these permanent structures and facilities and equipment staging and borrow areas are currently unknown. Specific locations would be determined definitively prior to or during the CP or COL phase.

SERI (2005) denotes the total area that would be disturbed by construction of the Grand Gulf ESP facility to be 162 ha (400 ac). In Figure 2-5, however, SERI (2005) denotes the area disturbed by construction to be a total of about 160 ha (395 ac) of the Grand Gulf site with 138 ha (340 ac) in the uplands (hardwood forests, fields, and previously disturbed areas) and 22 ha (55 ac) in the bottomlands (palustrine, forested, seasonally flooded wetland). Disturbance would result from construction of permanent structures and facilities and temporary equipment staging and borrow areas. About 51 ha (125 ac) or 31 percent of the total 160 ha (395 ac) disturbed area would be occupied by permanent structures and facilities, about 41 ha (100 ac) in the uplands and 10 ha (25 ac) in the bottomlands (SERI 2005).

SERI did not indicate in its environmental report (SERI 2005) the quantity of upland hardwood forest, upland field, and previously disturbed area in the uplands that would be occupied by permanent structures and facilities. Therefore, these quantities were estimated as follows. It is known that disturbance of a total of 59 ha (145 ac) of upland hardwood forests, 43 ha (105 ac) of upland fields, and 36 ha (90 ac) of previously disturbed areas in the uplands would occur (SERI 2005), totaling 138 ha (340 ac). Thus, the proportions of total disturbance in upland hardwood forests, upland fields, and previously disturbed areas in the uplands would be 43 percent, 31 percent, and 26 percent, respectively. These percentages were applied to the total amount of disturbance in the uplands that would be dedicated to permanent structures and facilities (41 ha (100 ac)). This yielded 17 ha (43 ac) of upland hardwood forests, 13 ha (31 ac) of upland fields, and 11 ha (26 ac) of previously disturbed areas in the uplands that would be occupied by permanent structures and facilities. This assumes the amount of total disturbance is related 1:1 to the amount of disturbance dedicated to permanent structures and facilities.

The remaining 109 ha (270 ac) that would be disturbed on the Grand Gulf site (97 ha (240 ac)) in the uplands and 12 ha (30 ac) in the bottomlands) would be for equipment staging and borrow areas and the associated impact is expected to be temporary (SERI 2005). However, unless managed, such areas would likely become colonized by invasive weedy plant species. Based on the lack of hardwood forest succession in areas disturbed during construction of the GGNS Unit 1 facility and in old fields (SERI 2005), as noted above, weedy plant species invasion would likely decelerate or entirely prevent hardwood forest succession. Without implementing proactive restoration plans, such areas would be unlikely to succeed to hardwood forest and wetland communities in the foreseeable future. For the purposes of analysis, the staff assumed that an applicant would likely develop hardwood forest and wetland restoration plans prior to or during the CP or COL phase. Wetlands could be restored or created anew, as would be specified in the ACE Section 404 permit (for excavation or clearing in jurisdictional wetlands) that would be obtained by an applicant prior to beginning construction. This permitting process would also ensure that the impacts of construction would be limited by requiring that appropriate construction best management and mitigation practices are followed.

An embayment intake structure, located on the east bank of the Mississippi River north of the existing barge slip, would be constructed to provide makeup water for the Grand Gulf ESP facility. A new shoreline discharge structure would be constructed just downstream of the entrance of the embayment. The river shoreline has been revetted (rip-rap emplaced for bank stabilization) by the ACE to stabilize the course of the river. Bank stabilization measures would be restored and preserved following any construction on the shore.

4.4.1.2 Wildlife Habitat along the Transmission Line Rights-of-Way

The transmission and distribution system existing at the time of startup and operation of the Grand Gulf ESP facility would be relied upon to distribute the power generated by a new ESP facility (SERI 2005). A study conducted by SERI concluded that the existing system would be adequate for an additional 1311 MW(e) generating capacity, assuming that modifications and upgrades are made to equipment in the switchyard of the GGNS Unit 1 facility. However, the maximum generating capacity identified in the PPE is approximately 3000 MW(e) (SERI 2005). If 3000 MW(e) generating capacity is installed, the existing transmission lines would have to be upgraded or additional transmission lines would be needed. This issue is discussed more fully in Section 4.1.2.

The location and nature of the environmental impacts associated with the construction of any transmission system improvements would be established definitively by the transmission and distribution system owner and operator (currently Entergy Mississippi, Inc.) prior to or during the CP or COL phase. The remainder of this section describes three reasonable scenarios that span the range of construction impacts that could be incurred, should new transmission lines be added to the existing system. Implicit in all three of these scenarios are the following assumptions made by the staff: (1) temporary construction areas in forest habitat would be reforested/restored as nearly as possible to preconstruction conditions; (2) prior to beginning construction, SERI would obtain an ACE Section 404 permit - this permitting process would ensure that the impacts of construction, in any wetlands or floodplains crossed by the transmission line rights-of-way, would be limited by requiring that appropriate construction best management and mitigation practices are followed; (3) right-of-way clearing and waste disposal methods would likely be dictated in large part by land the owner - however, absent direction from the property owner(s), clearing and waste disposal would be done in accordance with industry guidelines and best management practices.

| In the first scenario, new transmission lines would be added to existing support structures (e.g., via stacking) such that the effects of associated construction would occur entirely within the existing 40.3-km (25.2-mi) Baxter-Wilson and 69.8-km (43.6-mi) Franklin 500-kV corridors currently used to transmit electricity from GGNS Unit 1 (see Section 3.3). In this scenario, impacts would occur to wildlife habitat in established rights-of-way that are currently maintained via mechanical means and low-toxicity herbicides (see Section 2.7.1.1). The resulting impacts to wildlife habitat would be SMALL.

| In the second scenario, new transmission lines and support structures would be added adjacent to the existing corridors, and the effects of associated construction would result in a doubling of the existing rights-of-way. The total area of both the Baxter-Wilson and Franklin transmission line rights-of-way that has adjacent undeveloped land (mostly forest) is 524 ha (1296 ac) (see Section 4.1.2). The total area of both the Baxter-Wilson and Franklin rights-of-way that has adjacent water or wetlands is 39 ha (96 ac) (see Section 2.2.1). Consequently, a substantial quantity of hardwood forest habitat (524 ha (1296 ac)) could be lost and a relatively small area of wetlands could be affected if the rights-of-way needed to be doubled in width. SERI did not indicate in its environmental report (SERI 2005) whether any special habitat areas are crossed by the Baxter-Wilson and Franklin transmission line rights-of-way, and no such information is available from the transmission and distribution system owner and operator, Entergy Mississippi, Inc. (Entergy Services 2004). Impacts to wildlife habitat from doubling the existing rights-of-way would be MODERATE, based on effects to hardwood forest and wetlands.

| In the third scenario, one or more new corridors would be needed to accommodate the addition of new transmission lines. The locations of any such new corridors cannot be predicted with any reliability. However, because of the relatively large expanses of intact hardwood forest in the region surrounding the Grand Gulf site and the Baxter-Wilson and Franklin corridors, any new corridors could readily cross such forests over most of their length. In addition, wildlife habitat of relatively high quality (e.g., wetlands) or unique value (e.g., State wildlife areas) could be crossed. Therefore, construction impacts to wildlife habitat from creation of one or more new corridors could range from MODERATE to LARGE.

| An applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide additional information on the location and nature of environmental impacts associated with construction of any transmission system improvements. Therefore, the issue of construction impacts on wildlife habitat along the transmission line rights-of-way is unresolved.

4.4.1.3 Wildlife Habitat Impact Summary

In summary, an estimated 17 ha (43 ac) of upland hardwood forest habitat on the Grand Gulf site would be lost to permanent structures and facilities associated with construction of the proposed ESP facility. This represents about 11 percent of the total 162 ha (400 ac) of upland hardwood forest habitat currently available onsite (Figure 2-5). An estimated 13 ha (31 ac) of upland field habitat would be lost to permanent structures and facilities, representing about 20 percent of the total 63 ha (155 ac) of upland field habitat currently available onsite (Figure 2-5). An estimated 11 ha (26 ac) of previously disturbed area in the uplands would be lost to permanent structures and facilities. The total amount of previously disturbed area currently available in the uplands is unknown. Ten hectares (25 ac) of bottomland palustrine, forested, seasonally flooded wetland would be lost to permanent structures and facilities, representing about 3 percent of the 358 ha (885 ac) of bottomland forested wetland currently available onsite (Figure 2-5). Upland hardwood forests and bottomland wetlands have much greater plant species and structural diversity than upland fields and previously disturbed areas, and are thus assumed to be much more important as wildlife habitat. Previously disturbed areas have minimal wildlife habitat value. Because the combined upland hardwood forest and bottomland forested wetland lost to permanent structures and facilities represents only about 5 percent of the combined total of these available onsite, this impact would be SMALL and additional mitigation would not be warranted.

Impacts on the 109 ha (270 ac) of the Grand Gulf site that would be disturbed for equipment staging and borrow areas are expected to be temporary (SERI 2005) because SERI intends to restore the hardwood forest and wetland. With the assumption that temporary construction areas in forest habitat would be reforested/restored, the impacts, being temporary in nature, would also be SMALL and additional mitigation would not be warranted.

The location and nature of environmental impacts associated with construction of any transmission system improvements would be established definitively by the transmission and distribution system owner and operator prior to or during the CP or COL phase under the process described in Section 4.1.2. Because this analysis would be needed to determine the impacts of transmission system improvements on wildlife habitat, this issue is unresolved.

4.4.1.4 Wildlife

During construction of the Grand Gulf ESP facility, wildlife may be destroyed or displaced, primarily as a result of operating heavy equipment (during land clearing, for example). Less mobile animals, such as reptiles, amphibians, and small mammals, are expected to incur greater mortality than more mobile animals, such as birds. Ample undisturbed forested wetland habitat onsite would be available to displaced animals during construction. Species that can adapt to disturbed or developed areas such as raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), and northern cardinal (*Cardinalis cardinalis*), may readily recolonize portions of the disturbed area where suitable habitat remains or is replanted or restored. All forested or wetland areas that are disturbed and replanted or restored would likely be recolonized by wildlife communities similar to those that currently occupy these areas. The destruction, displacement, and recolonization of wildlife also apply to offsite disturbances in forest habitat that could result if the transmission system improvements described above were undertaken. To minimize construction-related impacts on wildlife, such as the destruction of nests and eggs of migratory birds, SERI would adhere to permit conditions that may restrict the timing of construction activities based on important biological periods (the nesting of migratory birds, for example).

Construction of the Grand Gulf ESP facility would be done according to Federal and State regulations, permit conditions, existing procedures, good construction practices, and established best management practices (for example, directed drainage ditches, and silt fencing would be used). Fugitive dust would be minimized by watering the access roads and construction site as necessary. Thus, the impact from dust would be negligible and further mitigation is not warranted. Emissions from heavy construction equipment would be minimal because of scheduled equipment maintenance procedures.

Construction activities would generate noise resulting from the movement of workers, materials, and equipment, and the operation of construction equipment (such as earth-moving equipment, portable generators, pile drivers, pneumatic equipment, and hand tools). Noise from construction can affect wildlife by inducing physiological changes, nest or habitat abandonment, behavioral modifications, or it may disrupt communications required for breeding or defense (Larkin 1996). However, it is not unusual for wildlife to habituate to such noise (Larkin 1996). Continuous noise levels from construction activities would range from 69 to 98 dBA at 15 m (50 ft) from the source (SERI 2005). At 732 m (2400 ft), this noise level would be reduced to 65 dBA (SERI 2005), well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Additionally, construction would occur near the GGNS Unit 1 facility, where wildlife have presumably become accustomed to typical operating facility noise levels. Thus, impacts on wildlife from construction noise are expected to be negligible.

Avian collisions with fabricated structures are a result of numerous factors related to species' characteristics such as flight behavior, age, habitat use, seasonal habits, and diurnal habitats; and to environmental characteristics such as weather, topography, land use, and orientation of the structures. Most authors on the subject of avian collisions with utility structures agree that collisions are not a significant source of mortality for thriving populations of birds with good reproductive potential (EPRI 1993). The NRC (1996) reviewed monitoring data concerning avian collisions at nuclear power plants with large cooling towers and determined that overall avian mortality is low. No avian collisions with existing structures at the Grand Gulf site have been noted (SERI 2005), although no plan is in place to monitor avian mortality. Nevertheless, the number of construction-related bird collisions with structures is expected to be negligible.

Grand Gulf Road off U.S. Highway 61 currently provides the only road access to the Grand Gulf site. The most recent daily traffic count on the segment of Grand Gulf Road nearest to the site is 940 to 1100 vehicles per day (see Section 4.5.4.1). This number is projected to increase during construction of the Grand Gulf ESP facility by 1100 vehicles per shift in a two-shift day (see Section 4.5.4.1). This would likely increase traffic-related wildlife mortalities. Local wildlife populations could suffer declines if roadkill rates were to exceed the rates of reproduction and immigration. However, while roadkills are an obvious source of wildlife mortality, except for special situations not applicable to the Grand Gulf site (e.g., ponds and wetlands crossed by roads where large numbers of migrating amphibians and reptiles would be susceptible), traffic mortality rates rarely limit population size (Forman and Alexander 1998). Consequently, the overall impact on local wildlife populations from increased vehicular traffic on Grand Gulf Road during construction would be expected to be negligible.

State-Listed Species

Animal Species

The State-listed endangered wood stork (*Mycteria americana*) was observed in summer on Gin and/or Hamilton Lakes during 18 years prior to construction of the GGNS Unit 1 facility (AEC 1973). The wood stork should thus still be considered a possible non-breeding transient to the Grand Gulf site and vicinity (SERI 2005; MNHP 2004a, 2004b). Consequently, it is possible that construction activities could disturb non-breeding storks and that such disturbance could result in feeding and associated energetic losses. However, because wood storks are present only for a short duration in the area, any disturbance due to construction would be considered negligible in terms of its effects on population viability, which is largely determined by the success of the species on its breeding grounds in Alabama, Florida, Georgia, and South Carolina (49 FR 7332; FWS 1996).

Plant Species

The critically imperiled hairy waterclover (*Marsilea vestita*), the jug orchid (*Platythelys querceticola*), the imperiled glade fern (*Diplazium pycnocarpon*), and the American bittersweet (*Celastrus scandens*) are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b). The critically imperiled Allegheny monkeyflower (*Mimulus ringens*) is known to occur about 17.6 km (11 mi) from the Grand Gulf site (SERI 2005). Based on these distances, these five species would not be affected by construction activities. However, the range of habitat affinities of these species spans hardwood forest, roadsides, forest margins, and wetlands, all general habitat types that occur in relative abundance on the Grand Gulf site. Thus, although they are not known to occur in close proximity to the site, these five species could yet occur on the Grand Gulf ESP site and along its transmission line rights-of-way. Consequently, upland and bottomland areas on the Grand Gulf ESP site that would be disturbed by construction (for example, land clearing, staging of equipment, excavation of borrow sites, etc.) should undergo a botanical survey prior to initiating such activities.

In summary, the impact on wildlife, including State-listed species, from construction of the Grand Gulf ESP facility and construction associated with any transmission system improvements, including land clearing, noise, bird collisions, and traffic-related mortality, is expected to be negligible.

4.4.1.5 Terrestrial Ecosystems Impact Summary

The impact of construction on wildlife habitat on the Grand Gulf site (including permanent and temporary losses of upland hardwood forest and bottomland forested wetlands) would be minimal. The impact on wildlife populations, including State-listed species, onsite would also be minimal. However, impacts on wildlife habitat and populations associated with the transmission system could be SMALL if additional transmission capacity were to be accommodated within the existing right-of-way, or MODERATE to LARGE if the right-of-way were to be expanded or if new rights-of-way were needed. Therefore, the staff concludes that this issue is not resolved, and an applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide additional information on the location and nature of environmental impacts associated with construction of transmission system improvements.

4.4.2 Aquatic Ecosystems

Impacts on the aquatic ecosystem from construction of the Grand Gulf ESP facility would be associated with construction of new cooling water intake and discharge structures and widening of transmission line rights-of-way. Construction along the Mississippi River would result in the removal or reshaping of the shoreline. These activities would likely lead to loss of benthic macroinvertebrates and some shoreline habitat along the Mississippi River, as well as temporary displacement of other aquatic species (SERI 2005). Construction of the trenches for the intake and discharge pipelines from the bank of the Mississippi River to the Grand Gulf ESP facility site could lead to temporary soil erosion and increased turbidity for the streams, lakes, and ponds onsite.

The proposed location for a new intake structure is at or near the north side entrance of the existing barge slip. Water from the Mississippi River would be used as makeup water to the cooling towers and service water system, and other miscellaneous water uses. The structure would be located at Mississippi River Mile (RM) 406.4. Water would be withdrawn from an embayment through piping connected to pumps and equipment housed in an intake pumping station located on shore. During construction, the existing riprap along the barge slip would be removed and dredging would be required to excavate the embayment for the location of the intake screens. Construction activities would be restricted to periods when river water level was low. The exposed areas are expected to be sandy, based on information obtained during construction of GGNS Unit 1. Very little turbidity and siltation is expected from construction activities at the shoreline through the use of standard construction practices (SERI 2005).

The construction activities for a new cooling water intake, discharge structures, and a possible widening of the transmission line right-of-way that could affect the Mississippi River are described below.

- Dredging. Dredging impacts on the banks of the Mississippi River would be minimal because of the localized area and the temporary nature of construction of the intake and discharge structures. Temporary increase in turbidity may occur in the river near the Grand Gulf ESP site during dredging; however, dredging operations would be in compliance with ACE and MDEQ requirements so that long-term water quality is not degraded.

- Construction of Cooling Towers and Onsite Impacts on Water Sources. These activities could lead to soil erosion into streams. During construction, the river may also receive dewatering effluent from trenching in the floodplain, or runoff from the bluff area via onsite streams and Hamilton Lake. Site runoff reaching the Mississippi River via Hamilton Lake is buffered by the lake and the sedimentation ponds. Any water-quality impacts on the Mississippi River during construction of a new facility would be similar to the impact during the construction of GGNS Unit 1. Construction of GGNS Unit 1 did not result in any significant impacts on the water quality of the Mississippi River (SERI 2005).

- Construction for Pipelines. Excavation for burial of approximately 1.8 km (1.1 mi) of intake and discharge pipelines would directly affect wetlands in the floodplain. Construction would be primarily along the existing haul road for GGNS Unit 1, leading to minimal incremental impacts on the wetland. The pipes would be buried, so there would be no permanent alteration of water flow patterns in the floodplain. Construction of the pipeline connecting the power block to the cooling tower area would need to cross a small existing wetland. This would require approval from the ACE, and all work would be performed in accordance with the permit.

The construction activities for the possible need to widen the transmission line rights-of-way would affect several waterways. The Baxter-Wilson right-of-way crosses the Big Black River, and the substation in Warren County is within 0.75 km (0.47 mi) of the Mississippi River. The Franklin right-of-way crosses Bayou Pierre approximately 5.5 km (3.4 mi) to the south of the Grand Gulf site. Plans for widening the right-of-way have not been developed. NRC expects that SERI would work with the appropriate Federal and State agencies and the transmission line owner, Entergy Mississippi, Inc., to develop and implement plans for widening the transmission line rights-of-way that would have minimal impacts on the aquatic ecosystems.

State-Listed Species

Animal Species

The endangered crystal darter (*Crystallaria asprella*) is found in Bayou Pierre and its tributaries, which flow as close as 3 km (1.9 mi) east of the Grand Gulf site (Ross 2001; MNHP 2004b; Katula 2004). Construction activities at the Grand Gulf ESP site would not affect the regions where the crystal darter is found. The Franklin transmission line right-of-way crosses Bayou Pierre approximately 5.5 km (3.4 mi) to the south of the Grand Gulf site. NRC expects that SERI would work with the appropriate State agencies and the transmission line owner, Entergy Mississippi, Inc., to develop and implement plans for the possible widening of the transmission line rights-of-way that would have minimal impacts on Bayou Pierre and the crystal darter.

Plant Species

No State-listed aquatic plant species are known to occur within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b).

After reviewing these construction activities and their potential impacts on aquatic ecological resources, the staff concludes that the overall impacts would be SMALL because these activities would take place for a limited time and could be readily mitigated (SERI 2005). Appropriate construction mitigation would include instituting best management practices for erosion control into the Mississippi and Big Black rivers, Bayou Pierre, and other potentially affected streams. The staff will verify the necessary construction surveys and monitoring prior to issuance of a CP or COL that references the Grand Gulf ESP.

4.4.3 Threatened and Endangered Species

The potential impacts of construction of the Grand Gulf ESP facility and possible expansion of the transmission line rights-of-way on terrestrial and aquatic Federally listed threatened and endangered species was evaluated. These species were identified through correspondence with the U.S. Fish and Wildlife Service (FWS) (FWS 2004a, 2004b), National Oceanic and Atmospheric Administration (NOAA) Fisheries (NMFS 2004), and Mississippi Natural Heritage Program (MNHP) (MNHP 2004a, 2004b) and review of FWS county listings of such species for the state of Mississippi (FWS 2000).

4.4.3.1 Federally Listed Animal Species

The potential impacts of construction activities on Federally listed animal species are described below.

Florida Panther - Endangered

Currently no viable populations of the Florida panther occur outside of Florida (SERI 2005). Reports of Florida panthers (*Puma concolor coryi*) seen within 3.2 km (2 mi) of the Grand Gulf site are from 1973 (MNHP 2004c) and are suspect because a viable population of Florida panthers has not been known in the state of Mississippi since the late 1800s (MNHP 2004d). Therefore, the potential impact on Florida panthers from construction at the Grand Gulf ESP site is considered minimal.

American Alligator - Threatened

The American alligator (*Alligator mississippiensis*) is currently classified as "threatened based on similarity of appearance" to the American crocodile (*Crocodylus acutus*) throughout its range, including Mississippi. The classification helps prevent excessive hunting of the alligator and protects the American crocodile (52 FR 21059). Alligator populations are considered disjunct, limited to available habitat, but stable. Because wetlands would be minimally affected by construction at the Grand Gulf ESP site (see Section 4.4.1.1), impacts on alligators would be considered negligible.

Bald Eagle - Threatened

The Grand Gulf site lacks dominant living pine (*Pinus* spp.) or bald cypress (*Taxodium distichum*), the trees in which bald eagle nest (FWS 2004a). Eagle occurrences have not been reported within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b). Eagle occurrences have also not been reported in Warren County except for one nest site at Halpine Lake. This nest site is located along the Mississippi River north of Vicksburg several miles south of Eagle Lake (MMNS 2005). The nest site is thus several miles north of the terminus of the Baxter-Wilson transmission line right-of-way at the Baxter-Wilson Substation. Consequently, bald eagles are unlikely to be affected by construction at the Grand Gulf ESP site or by possible expansion of the Baxter-Wilson transmission line right-of-way.

However, bald eagle locations are obtained on a volunteer basis in Mississippi. No field surveys of potential nest trees, nesting or roosting eagles, or foraging concentrations of eagles have been conducted at the Grand Gulf site or along its transmission line rights-of-way. Thus, bald eagles could potentially use the Grand Gulf site and the environs along the Baxter-Wilson transmission line right-of-way. Before beginning construction activities on the Grand Gulf site, especially those occurring in the bottomlands (e.g., construction of pipeline and intake structures), the adjacent Mississippi River shoreline should be surveyed for potential nest trees (dominant living pine [*Pinus* spp.] or bald cypress [*Taxodium distichum]*) and nesting eagles during the reproductive season (September to January). Any eagles observed in the area should be reported to the FWS and Mississippi Museum of Natural Science (MMNS) in Jackson, Mississippi prior to commencing construction activities. In the event the Baxter-Wilson transmission line right-of-way is widened in support of the Grand Gulf ESP facility, any bald eagles observed in the area should likewise be reported to the FWS and MMNS prior to nearby construction.

Interior Least Tern - Endangered

Least terns (*Sterna antillarum*) on the Mississippi River (whether nesting, foraging, or loafing) generally are not disturbed by operation of machinery (including dredges, tow boats, etc.) in the near vicinity. Generally, least terns are disturbed only by activities that take place on the sand bar they occupy (ACE 2004b).

The nearest areas occupied by least terns upstream and downstream of the Grand Gulf site (RM 405 (SERI 2005)) were at Yucatan Dikes (RM 409.8) (loafing area for 28 birds on the Louisiana side of the river), Togo Island Dikes (RM 413.6) (nesting colony of 395 birds on the Mississippi side of the river), and Below Bondurant Towhead Dikes (RM 393.0) (nesting colony of 59 birds on the Louisiana side of the river) (ACE 2004a). These three areas are all located at least 6.4 km (4 mi) from the Grand Gulf site, far enough distant to preclude disturbance of terns from construction activities at the site. Further, the nearest potential (currently unoccupied) tern nesting habitat is at about RM 402 on the Louisiana side of the Mississippi River, about 4.8 km (3 mi) south of the Grand Gulf site (ACE 2004b), well outside the range of disturbance from construction activities at the site.

The point at which the Baxter-Wilson transmission line right-of-way is nearest the Mississippi River is at the Baxter-Wilson Substation, located about 0.75 km (0.47 mi) from the river at RM 433.1. The nearest areas occupied by terns downstream and upstream of the Baxter-Wilson Substation were at Below Racetrack Dikes (RM 429.0) (nesting colony of 91 adults on the Mississippi side of the river) and at Milliken Bend (RM 456.0) (one adult tern observed on the Louisiana side of the river) (ACE 2004b). These two areas are located at least 6.4 km (4 mi) from the Baxter-Wilson Substation, far enough distant to preclude disturbance of terns from right-of-way expansion activities in the vicinity of the substation.

Between Togo Island Dikes and Below Racetrack Dikes there are two other areas occupied by terns: (1) Newton Bend Dikes (RM 419.5) (nesting colony of 14 birds on the Mississippi side of the river) and (2) Across from Logo Landing (RM 418.3) (nesting colony of 58 birds on the

Louisiana side of the river) (ACE 2004b). These two areas are estimated at being approximately 3.2 km (2 mi) from the Baxter-Wilson transmission line right-of-way, far enough distant to preclude disturbance of terns from right-of-way expansion activities.

Consequently, any impacts on interior least terns that could result from construction at the Grand Gulf ESP site and possible expansion of the Baxter-Wilson transmission line right-of-way would be considered negligible.

Red-Cockaded Woodpecker - Endangered

The red-cockaded woodpecker (*Picoides borealis*) is not known, either currently or historically, from Claiborne and Warren counties (Costa and Walker 1995). Thus, there would be no impacts on the species from construction at the Grand Gulf ESP site and possible expansion of the Baxter-Wilson transmission line right-of-way.

Six historic (inactive) red-cockaded woodpecker clusters (colonies) are located within 3.2 km (2 mi) of the Franklin transmission line right-of-way where it crosses the Homochitto National Forest in Franklin and Lincoln counties (USFS 2005a). Of the six, the closest to the Franklin right-of-way is about 1.2 km (0.75 mi) (USFS 2005a). The USFS is required to maintain foraging habitat in areas of historic clusters located outside Habitat Management Areas (HMA) designated for the recovery of the species (USFS 2005b). Thus, based on these distances and doubling the current right-of-way width of 61 m (200 ft) (Section 3.3), there would be no impacts on red-cockaded woodpecker foraging habitat from possible doubling of the width of the Franklin transmission line right-of-way where it crosses the Homochitto National Forest in Franklin and Lincoln counties.

The nearest and only HMA on the Homochitto National Forest is located about 16 km (10 mi) southwest of the Franklin transmission line right-of-way in Franklin County (USFS 2005a). Thus, based on the current distribution of the species (i.e., active clusters within the HMA), there would be no impacts on red-cockaded woodpeckers from possible expansion of the Franklin transmission line right-of-way where it crosses the Homochitto National Forest in Franklin County.

However, in the future red-cockaded woodpeckers could inhabit restored old-age longleaf pine (*Pinus palustris*) stands located outside the HMA that are currently being and will continue to be enhanced to attract the species (see Section 2.7.1.2) (USFS 2005c). Thus, in the event that the Franklin transmission line right-of-way is expanded, the USFS Homochitto National Forest in Meadville, Mississippi should be contacted to ascertain the proximity of red-cockaded woodpeckers prior to any forest clearing.

In summary, potential impacts on red-cockaded woodpeckers that could result from construction at the Grand Gulf ESP site and possible expansion of the Franklin transmission line right-of-way would be considered negligible.

Louisiana Black Bear - Threatened

The Louisiana black bear (*Ursus americanus luteolus*) is known to occur within 3.2 km (2 mi) of the Grand Gulf site (MNHP 2004a). The Louisiana black bear was reported on the Grand Gulf site in the late 1970s (NRC 1981) (see Section 2.7.1.2), but has not been documented on the site since that time (SERI 2004d). However, because the site and its immediate environs to the north and south provide a large block of remote habitat with relatively little human presence, Louisiana black bears may still exist onsite.

Preferred habitat for Louisiana black bears consists of bottomland hardwood forests. Upland forests generally are not considered preferred habitat for the subspecies. Hence, the significant population decline in Louisiana black bears is largely because of past conversion of bottomland hardwood forests to agriculture. However, bears are somewhat nomadic (with very large home ranges), and it is reasonable to assume they periodically use upland forests that are adjacent to bottomland hardwoods (FWS 2004b).

Consequently, the impacts of construction to bottomland forested wetland and upland hardwood forest on the Grand Gulf ESP site are integral to the evaluation of potential impacts on the Louisiana black bear. Seventeen hectares (43 ac) or 11 percent of the 162 ha (400 ac) of upland hardwood forest currently available onsite (Figure 2-5) could be lost to permanent structures for the Grand Gulf ESP facility. An estimated additional 41 ha (102 ac) of upland hardwood forest (see Section 4.4.1.1) would be temporarily disturbed for equipment staging and borrow areas, representing 26 percent of the upland hardwood forest currently available. Thus, a total of 37 percent of the upland hardwood forest currently available on the Grand Gulf site would be disturbed, and forest fragmentation would increase (Figure 2-5).

Approximately 10 ha (25 ac) or 3 percent of the 358 ha (885 ac) of bottomland palustrine, forested, seasonally flooded wetland would be displaced by permanent structures. An additional 12 ha (30 ac) of bottomland palustrine, forested, seasonally flooded wetland would be temporarily disturbed for equipment staging and borrow areas, representing an additional 3 percent of the bottomland forested wetland currently available. Thus, a total of 6 percent of the bottomland forested wetland currently available onsite would be disturbed. This disturbance would widen a band of currently developed land that stretches from the base of the Loess Bluffs to the Mississippi River (Figure 2-5), but would not result in any further fragmentation of bottomland hardwood forest. This would not be expected to pose a barrier to potential bear movements in the bottomlands along the river.

The preponderance of habitat used by bears would be expected to occur in bottomland forested wetland, where there would be relatively minor habitat destruction and no additional fragmentation. Thus, impacts on the Louisiana black bear from construction at the Grand Gulf ESP site are expected to be minor, as long as this does not result in the mortality of individual bears. Prior to disturbance of any bottomland forested wetland or upland hardwood forest, a bear survey should be conducted to determine use of the area. If denning bears are present, construction activities should be prohibited during the denning season (from December through April) in order to avoid destruction of bears and possible abandonment of cubs. Further, actual den sites/trees or candidate trees (bald cypress [*Taxodium distichum*] and tupelo gum [*Nyssa* sp.]) with visible cavities, having a diameter at breast height of 0.9 m (3 ft) and occurring along river, lakes, streams, bayous, sloughs, or other water bodies in occupied habitat should not be harvested (FWS 2004e). If these measures are undertaken, mortality of individual bears would be considered unlikely.

The Louisiana black bear is known from counties other than Claiborne (Franklin, Jefferson, Warren) that are crossed by the transmission line rights-of-way (Baxter-Wilson and Franklin) (Section 2.7.1.2). The subspecies is known to occur only in the western most portion of Franklin County where hardwood forests are more prevalent (USFS 2005d). The subspecies is also known to occur only in the western most portion of Jefferson County near the Mississippi River (USFS 2005d). The Franklin transmission line right-of-way traverses the northeastern portions of Franklin and Jefferson counties and is thus at least 32 km (20 mi) distant from the nearest sighting of the Louisiana black bear in these counties. Thus, possible expansion of the Franklin transmission line right-of-way would be unlikely to impact the subspecies.

However, the Louisiana black bear is known to occur along the Mississippi River in Warren County (see Section 2.7.1.2), in the general area crossed by the Baxter-Wilson transmission line right-of-way. The point along the Baxter-Wilson transmission line right-of-way that is nearest the Mississippi River is a 1.6-km (1-mi) segment of right-of-way located about 0.75 km (0.47 mi) from the river. Elsewhere along the right-of-way, the closest the right-of-way comes to the Mississippi River is approximately 3.1 km (2 mi). Based on these distances, the majority of the Baxter-Wilson transmission line right-of-way appears to be located in upland hardwood forest (as opposed to bottomland hardwood forest, the Louisiana black bear's preferred habitat). Consequently, possible expansion of the Baxter-Wilson transmission line right-of-way would be unlikely to impact the subspecies.

In addition to habitat destruction, vehicle collisions with bears would likely increase. The most recent daily traffic count on the segment of Grand Gulf Road nearest to the Grand Gulf site is 940 to 1100 vehicles per day (see Section 4.5.4.1). This number is projected to increase during construction of the Grand Gulf ESP facility by 1100 vehicles per shift in a two-shift day (see Section 4.5.4.1). This would be expected to increase the likelihood of vehicle collisions with bears. However, such encounters would likely be so rare that the overall impact on the local population of Louisiana black bears would be expected to be negligible. In general, vehicle collisions are considered relatively minor compared to habitat destruction or modification.

Noise levels would increase from land-clearing equipment during construction at the Grand Gulf ESP site. Denning is the most critical period for bears, particularly pregnant females. Consequently, if bears are present, construction activities in the vicinity of a den tree should be limited during the denning season (December through April) (FWS 2004e). Construction noise outside the denning season may cause bears, if present, to use more remote forested areas. However, this would not be likely to adversely affect bears to any great degree. In general, construction noise is considered relatively minor compared to habitat destruction or modification.

In summary, the potential impact on the Louisiana black bear from construction at the Grand Gulf ESP site and along the transmission line rights-of-way is considered negligible.

Gulf Sturgeon - Threatened

The gulf sturgeon (*Acipenser oxyrinchus desotoi*) has not been collected in the region of the Grand Gulf site. The Mississippi River is considered part of the historical range for the gulf sturgeon, therefore the reach of the river at the Grand Gulf site may be used by the sturgeon as it migrates up and down the river (68 FR 13370; NMFS 2004). Construction of the proposed intake and discharge structures would temporarily change the river bank environment (Section 4.4.2). Widening the transmission line right-of-way would bring the end of the Baxter-Wilson right-of-way in Warren County to within 0.6 km (0.4 mi) of the Mississippi River. Thus, the potential impacts from construction would have no effect on the Mississippi River and the Gulf sturgeon.

Bayou Darter - Threatened

The bayou darter (*Etheostoma rubrum*) is endemic to the Bayou Pierre and tributaries, which flow as close as 3 km (1.9 mi) east of the Grand Gulf site (40 FR 44149; FWS 1990, 2000, 2004a; Ross 2001). The construction of the proposed intake and discharge structures would not affect the regions where the bayou darter is found. The Franklin transmission line right-of-way crosses the Bayou Pierre. In the event the transmission line rights-of-way need to be widened, NRC expects that SERI would work with the appropriate Federal and State agencies and the transmission line owner, Entergy Mississippi, Inc., to develop and implement plans that would have minimal impacts on the bayou darter.

Fat Pocketbook Mussel - Endangered

The fat pocketbook mussel (*Potamilus capax*) was historically found throughout the Mississippi River drainage from Minnesota to Louisiana. In 2003, the mussel was found near Vicksburg in the Mississippi River, as well as south of the Grand Gulf Site (41 FR 24062; FWS 1989, 2004c, 2004d; MNHP 2004e). Widening of the transmission line right-of-way in Warren County near the Mississippi River would not affect mussel habitat because the habitat is no closer than 0.6 km (0.4 mi) to the Mississippi River. Construction of the proposed intake and discharge structures would temporarily change the nearby river bank environment, and increase turbidity downstream of the in-river activities; however, this is likely to be localized and temporary and could be minimized by use of best management practices (Section 4.4.2). Nevertheless, disrupted regions of river substrate could be habitat for the mussel. The shoreline where the intake and discharge structures are proposed have been disrupted in the past, yet the area may have been re-colonized by mussels. Impacts on the mussel from construction activities cannot be evaluated without conducting surveys to determine if the mussels are using the shoreline where the proposed intake and discharge structures will be located. Any specimens found could be relocated. However, the regions that would be disturbed are a small proportion of the total length of river bank along the Grand Gulf site, and the overall impact on the fat pocketbook mussel is likely to be minimal.

Pallid Sturgeon - Endangered

Pallid sturgeon (*Scaphirhynchus albus*) have been collected in the region of the Grand Gulf site. Adult pallid sturgeon have been caught in regions with moderate to strong currents, a sand or sand/gravel substrate, similar to the main channel of the Mississippi River as it passes by the Grand Gulf site. Spawning habitat may exist within 16 km (10 mi) upstream of the Grand Gulf site (MP&L 1973). Information on the spawning and juvenile use of the Mississippi River near the Grand Gulf site is sparse (55 FR 36641; FWS 1993, 2000, 2004a; Ross 2001; Hartfield 2003; LDOTD 2003; SERI 2005). Construction of the proposed intake and discharge structures would temporarily change the river bank environment (Section 4.4.2). During construction activities, sedimentation and turbidity would be controlled using standard construction practices. While these practices could limit the use of the region by adult pallid sturgeon in the immediate vicinity of the site, the impact would be minor and temporary, if at all. The timing for construction is also not likely to affect any spawning or use of the region by juvenile pallid sturgeon because of the size of the river, the location of shoreline activities, and the limited in-river activities associated with the construction of the intake and discharge structures. Widening the transmission line right-of-way would bring the end of the Baxter-Wilson right-of-way in Warren County to within 0.6 km (0.4 mi) of the Mississippi River. Consequently, impacts on pallid sturgeon resulting from construction of the proposed Grand Gulf ESP facility would be unlikely.

4.4.3.2 Federally Listed Plant Species

| No impacts on Federally listed or proposed threatened or endangered plant species either terrestrial or aquatic are anticipated because none of these species are known to occur on or | within 16 km (10 mi) of the Grand Gulf site (MNHP 2004a, 2004b; FWS 2004a).

4.4.3.3 Threatened and Endangered Species Impact Summary

| Because SERI is not planning any preconstruction ground disturbing activities as a result of the | ESP, no Section 7 consultation with FWS or NOAA Fisheries is required at this time. However, | the issuance of a CP or COL is a separate action requiring a consultation with the appropriate | agency, pursuant to Section 7 of the Endangered Species Act.

| Based on the information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes the impacts of construction at the Grand Gulf ESP site on terrestrial and | aquatic Federally listed species would be SMALL, and additional mitigation would not be | warranted beyond that identified in this section. The conclusion of SMALL impacts by the NRC | staff is predicated on certain assumptions made by the staff. These include the current | occurrence of Federally listed threatened and endangered species and critical habitat in the | project area, the current listing status of such species, and the current designation of critical habitat.

4.5 Socioeconomic Impacts

Construction activities could affect individual communities, surrounding region, and minority and low-income populations. To assess the impacts of construction activities for the Grand Gulf ESP site, the staff evaluated the physical impacts, population, and community characteristics.

4.5.1 Physical Impacts

| Construction activities at the Grand Gulf ESP site may cause temporary and localized physical | impacts including, but not limited to, noise, odor, vehicle exhaust emissions, and dust. This section addresses the potential impacts that may affect people, buildings, roads, and recreational facilities.

4.5.1.1 Workers and the Local Public

The Grand Gulf site is located in an area zoned for industrial use. The site is bounded by agricultural and recreational areas. The recreational area likely to be most affected by construction on the Grand Gulf site would be the Grand Gulf Military Park because of an increase in traffic, noise, and dust from construction activities. However, peak park use is on the weekend when construction activity would likely be reduced.

All construction activities would occur within the Grand Gulf site boundary. Offsite areas that would support construction activities (such as borrow pits, quarries, and disposal sites) would already be permitted and operational. Therefore, impacts on those facilities from constructing new units would be small incremental impacts associated with their normal operation.

Construction workers would have adequate training and personal protective equipment to minimize the risk of potentially harmful exposures. Services would be provided for emergency first-aid care, and regular health and safety monitoring would be conducted during construction. However, during construction activities, the employees working the day shift at GGNS Unit 1 could be subjected to noise, dust, and gaseous pollutants associated with construction events. People living near the Grand Gulf ESP site would not experience any physical impacts greater than what would be considered an annoyance or nuisance. These activities would be performed in compliance with local, State, and Federal regulations, and site-specific permit conditions.

During construction, noise would increase with the operation of vehicles, earthmoving equipment, materials-handling equipment, impact equipment, and other stationary equipment (such as pumps and compressors), and the increase of human activity. The surrounding counties are predominantly rural tracts. However, areas that are subject to farming are prone to seasonal noise-related events, such as planting and harvesting. Wooded areas provide natural noise abatement. Noise level also attenuates with distance.

At this time, it is not known if blasting would be necessary during the construction of a new facility. Because people are more sensitive to changes in noise levels at night, any blasting, along with other excessively loud construction activities, would be conducted during daytime hours.

During a series of five bimonthly noise surveys that were conducted at various phases of the existing GGNS Unit I construction, the impact of construction noise was considered to be small and of a temporary nature. Noise levels during construction at the site boundaries are expected to be below the regulatory guidance of 65 dBA stated in NUREG-1555 (NRC 2000). A construction noise abatement and protection program would provide required mitigative measures for noise. On a short-term basis, noise may exceed this guidance; however, it is expected that noise from construction equipment would have no discernible impacts on the local noise level. All equipment would be operated in accordance with local, State, and Federal noise requirements.

Construction Impacts at the Proposed Site

The Noise Control Act of 1972 gives authority to the EPA to determine the limits of noise and to set noise emission standards for major sources of noise in the environment, including construction equipment. Federal regulations exist for noise emitted from construction equipment (40 CFR Part 204) and Occupational Safety and Health Administration provides regulations to deal with occupational exposure in the construction environment (29 CFR 1910.95). In addition to the local ordinances and permitted noise restrictions, SERI states that a restriction on noise-related activities (for example, blasting) to daylight hours could also be incorporated into activity planning (SERI 2005).

Physical impacts from air pollutants such as engine exhaust and fugitive dust would be limited. Therefore, no modeling was undertaken for this analysis. Temporary and minor effects on local ambient air quality occur as a result of normal construction activities. Emissions of fugitive dust and fine particulate matter, including those smaller than 10 micrometers (PM_{10}) in size, are generated during earth-moving and material-handling activities. Construction equipment and offsite vehicles used for hauling debris, equipment, and supplies also produce emissions during construction. The pollutants of primary concern include PM_{10} fugitive dust, reactive organic gases, oxides of nitrogen, carbon monoxide, and, to a lesser extent, sulfur dioxides. Because of the uncertainty of the variables affecting construction (for example, type of construction vehicles, timing and phasing of construction activities, and haul routes), precise estimates of emissions cannot be determined until the project is ready for construction, and no reasonable estimate of construction emissions can be undertaken. However, construction would be conducted in accordance with all Federal, State, and local regulations that govern construction activities and emissions from construction vehicles.

Specific mitigation measures to control fugitive dust would be identified in a dust control plan or similar document, prepared prior to project construction. SERI states that air pollution mitigation measures would include any or all of the following (SERI 2005):

- Wetting for dust suppression on unpaved construction roads and disturbed areas
- Maintain vegetative cover to minimize the area of disturbed soils
- Maintain construction vehicles properly to maximize efficiency and minimize emissions
- Re-vegetate temporarily impacted land
- Place emission controls on the onsite concrete batching plant
- Use technology designed for open burning (if needed) to increase the efficiency of combustion while reducing smoke levels, and conduct burning in compliance with applicable air-permitting requirements established by MDEQ.

While emissions from construction activities and equipment would be unavoidable, a mitigation plan would minimize impact on local ambient air quality and the nuisance impact on the public near the project. Other mitigation measures would include temporary storm water management and erosion and sediment control strategies.

4.5.1.2 Buildings

Construction activities would not affect any offsite buildings. Onsite buildings have been constructed to withstand safely any possible impact, including shock and vibration, from construction activities associated with the proposed activity. Except for GGNS Unit 1 structures, no other industrial, commercial, or residential structures would be directly affected by the construction of a new facility.

4.5.1.3 Roads

The use of public roadways and railways would be necessary to transport construction materials and equipment. The roadways could require some minor repairs or upgrading, such as patching and filling potholes, to allow safe equipment access. However, no extensive work is planned for the existing roads to support construction. The rail line that extended from Vicksburg, Mississippi, to the site and beyond and the spur constructed to the site to support GGNS Unit 1 construction have since been abandoned. No reconstruction of rail tracks along the former rights-of-way or construction of new rail lines is planned (SERI 2004d), but future consideration and evaluation of rail service is not precluded, and a rebuilt line may be required (SERI 2005). If rail service is needed at the CP or COL stage, NRC staff will evaluate the impact of restoring rail service on the Grand Gulf ESP site.

The transportation network at the Grand Gulf site in Claiborne County and in the surrounding counties of Copiah, Hinds, Jefferson, and Warren Counties in Mississippi and Tensas Parish across the Mississippi River in Louisiana is a well-developed system and would not be significantly affected as a result of construction activities. Several upgrades are planned or already underway that will lessen impacts (Section 2.8.2.2). Traffic on Grand Gulf Road will increase substantially during the peak construction period and will be at its peak during the morning and evening shift changes. Noise in the general area will increase from the larger volume of traffic, but the increases will be temporary and will only occur twice per day during the work week.

4.5.1.4 Aesthetics

An estimated 162 ha (400 ac) of the 850-ha (2100-ac) Grand Gulf site would be affected by construction of a new facility. Some areas of the site proposed for the new construction have been previously developed or altered for use by the existing GGNS Unit 1. New construction would have little impact in these areas. Of the roughly 162 ha (400 ac) estimated for the construction of a new facility, the staff estimates that 49 ha (120 ac) overlap currently undeveloped or unaltered areas (SERI 2004e, SERI 2005). It is estimated that 51 ha (125 ac) would contain permanent structures (primarily a power block area, cooling tower area, and bottomland pipeline and intake areas). Some construction activities for the new facility may be visible from the Mississippi River (for example, the embayment and intake structure, and cooling towers) and from Grand Gulf Military Park. However, much of the construction activity at the site would be masked by woods and the 20-m (65-ft) bluff to the east of the site. Because the Grand Gulf ESP site is already aesthetically altered by the presence of an existing nuclear power plant with a 158-m (520-ft) natural draft cooling tower, and because construction impacts would be temporary, adverse impacts on visual aesthetics of the site and vicinity are not expected from the construction of a new facility.

Water turbidity could temporarily increase in the immediate construction area during construction and localized dredging. Measures to control turbidity include permit conditions, use of best management practices, and, if necessary, installing a barrier (for example, silt curtain) to prevent the migration of a turbid water plume into Hamilton and Gin Lakes (SERI 2005).

Construction activities would include limited in-water activity to construct the intake structure and local dredging. The work would be executed in accordance with applicable regulations and permit conditions (SERI 2005).

4.5.1.5 Summary of Physical Impacts

Based on the information provided by SERI in its environmental report (SERI 2005) and the NRC staff's independent review, the staff concludes that the overall physical impacts of construction on workers and the local public, buildings, roads, and aesthetics would be SMALL as long as the mitigative actions, such as noise, dust, and traffic control and possible management measures identified by SERI are undertaken.

The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include no building of new roads or the former railroad line into the site, and carrying out mitigative actions to reduce physical impacts, such as limiting in-water activity, implementing measures to control noise, dust, and traffic, and other possible management measures identified by SERI.

4.5.2 Demography

The evaluation of the economic and social impacts on the immediate vicinity and surrounding region during construction of new units addresses both the potential impact that could result from the construction-related activities at the Grand Gulf ESP site and the activities and demands of the workforce on the surrounding region.

Construction of each new unit is estimated to occur over a 5-year period and may lag behind the preceding unit by a year or more. Because a specific reactor design has not been selected, the peak workforce estimate does not include consideration of reactor-specific approaches, which could limit the types of activities and reduce the length of time onsite.

Mississippi occupational employment statistics for the period 2002 to 2012 for the Hinds-Utica Community College district, which includes Hinds, Rankin, Warren, and Claiborne Counties, currently show over 10,700 workers in the construction occupations; over 10,000 maintenance, installation and repair workers; 420 plant and system operators; 8000 truckers; 1100 security guards; and 46,400 clerical and administrative workers (MDES 2005). All of these groups of occupations are forecasted to grow by about 10 percent to 20 percent by the year 2012. More workers also would be available from nearby counties. While these are currently employed workers, not all of whom would be available for construction and operation of a new nuclear plant, it does represent a significant pool of workers in the occupations that would be needed for construction and operation. Several of the highly specialized occupations such as pipe fitters, nuclear operators, engineers, technicians, and supervisors with specific nuclear experience would have to be recruited outside of the area, although some of these occupations might also be trained locally, given appropriate lead time and planning for educational programs. SERI assumed that 50 percent of the workforce would come from the region. The staff has examined SERI's assumption using occupational statistics and finds it reasonable.

The peak workforce is estimated by SERI (2005) to be 3150 people, a number that would be maintained for a large part of the construction period(s). SERI expects that the majority of construction workers and their families would settle into larger cities in the area or their associated suburbs, such as Vicksburg (Warren County), Natchez (Adams County), and Clinton/Jackson (Hinds County) (SERI 2005). According to the 2000 U.S. Census, these three counties have a combined population of more than 300,000 people (USCB 2004). Assuming that 50 percent of the construction workforce with an average family size of four would move into the region, an estimated 6300 people would move into the area within 80 km (50 mi) of the proposed Grand Gulf ESP site. This represents approximately 2 percent of the year 2000 population for Adams, Hinds, and Warren counties. If such a large workforce were introduced into the region, it could affect traffic, taxes, housing, and public services. Much of the workforce would probably be selected from the population currently within 80 km (50 mi) of the Grand Gulf ESP site. The magnitude of the impact is dependent on two considerations:

- The percentage of the workforce that would be existing residents of the region
- Where those who have to relocate to the region would reside. If substantial numbers of the workforce migrated into rural and small-town Claiborne and Jefferson counties, for example, the socioeconomic impacts generally would be larger than if they moved to the larger population centers.

Using information provided by SERI in its environmental report, the staff assumed that 50 percent of the construction workers would be expected to come from within the region and the number of construction workers who might relocate to the region would be a small percentage of the larger communities' population base, the staff concludes that the likely outcome is the impacts of construction on increases in population within most of the region would be SMALL, and additional mitigation would not be warranted. However, the possibility of a LARGE demographic impact in Claiborne County cannot be excluded. Impacts on the economy, taxes, infrastructure, and public services are covered in Sections 4.5.3 and 4.5.4.

The range of impacts estimated by the NRC staff is predicated on certain assumptions made by the staff. These include not more than 3150 construction workers would be employed at the Grand Gulf ESP site; not less than 50 percent of the construction workers would come from the region within 80 km (50 mi) of the Grand Gulf ESP site; and any new workers would choose to live in the larger cities within the region, such as Vicksburg and Jackson, rather than in smaller communities that have less available housing, such as Port Gibson and Fayette.

4.5.3 Social and Economic

This section evaluates the social and economic impacts on the surrounding region as a result of constructing additional nuclear units at the Grand Gulf ESP site. The evaluation assesses the impacts of construction and demands placed by the larger workforce on the surrounding region. Construction activities are expected to last 5 years and employ up to 3150 workers. SERI expects this size workforce to be maintained for a large part of the construction period (SERI 2005). This number is in addition to the 750 permanent and a variable number of contract personnel currently employed at the existing site (SERI 2005).

4.5.3.1 Economy

The impacts of construction of the new units on the local and regional economy are based on the region's current and projected economy and population. In addition to the 3150 direct construction jobs, spending in the region by these workers and purchase of non-labor goods and services to support construction would result in a "multiplier effect" within the counties surrounding the Grand Gulf ESP site. The multiplier effect describes the situation in which each dollar spent regionally on goods and services by construction workers and contractors becomes income to a regional recipient who saves some but spends the rest. This creates income for someone else, who in turn saves part and spends the rest. The number of times the final increase in spending in the region exceeds the initial dollar spent is called the regional "multiplier."

Based on the positive aspects of station construction on the regional economies (mostly in Warren County) and the workforce availability, the staff concludes that the impacts on the economy are generally beneficial and could reach the moderate level in Warren County.

The conclusion of beneficial moderate impacts in Warren County and small impacts elsewhere by the NRC staff is predicated on certain assumptions made by the staff. These include not more than 3150 construction workers would be employed at the Grand Gulf ESP site; not less than 50 percent of the construction workers would come from the region within 80 km (50 mi) of the Grand Gulf ESP site; and any new workers would choose to live in the larger cities within the region, such as Vicksburg and Jackson, rather than in smaller communities that have less available housing, such as Port Gibson and Fayette.

4.5.3.2 Taxes

The actual monetary value of the revenues generated from the construction of the new units cannot be estimated with precision because the type of reactor has not been selected. This decision would affect the size of the workforce and the percentage of the workforce that could come from outside the region. Therefore, at this time it is not possible to estimate the value of taxes that could be paid to the regional governments, nor expenditures that the regional governments would have to incur to accommodate the workforce.

Sales, Use, Income, and Franchise Taxes

The state of Mississippi and counties surrounding the Grand Gulf ESP site would experience an increase in the amount of taxes collected from labor, services, construction materials, and supplies purchased for the project. Mississippi would collect franchise taxes paid by contractors during construction of the additional units. State franchise taxes would be collected at the rate of $2.50 per $1000 on the capital value of equipment at the Grand Gulf ESP site (MSTC 2003a). The tax would be based on the value of property owned by the contractors that operate in Claiborne County during the construction period. Mississippi also collects a 3.5 percent contractors' tax on the total contract amount (including the tax itself) (MSTC 2003b). Additionally, sales, use, and income taxes would be generated by retail expenditures (restaurants, hotels, merchant sales) of construction workers. Although there is a small local sales and use tax, the State would collect most of these both from individual workers and from corporate entities in the general region of the site. No estimate is available of the day-to-day expenditures during construction that would occur in the region.

Property Taxes

Mississippi would benefit from additional property tax revenue for the incremental increase in value to the entire Grand Gulf site from the additional units. During the construction phase, this tax would be levied only on the value of the tangible personal property to become part of the additional units. Currently, it has not been decided whether the new facility would be treated for tax purposes as a "merchant plant" selling electric power to the eastern United States as a whole, whereupon it could be exempt from the special treatment in Mississippi tax law that taxes the GGNS property at the state level, allocates these funds by formula, and prevents the county from taxing the facility.

If the facility were treated as an ordinary industrial asset, the property tax would be a significant benefit to Claiborne County. If the final capital cost were in the range of $1000 per installed kilowatt, the maximum capacity 3000-MW(e) facility would (at completion) have an approximate capital value of $3 billion.

At Claiborne County's current average property tax rate of 65.01 mills and an assessment ratio of 15 percent of true market value for non-residential property (SERI 2004a), the tax yield would be about $29 million per year, a large beneficial impact. During the assumed construction period of 5 years, about $6 million in tax yield would be added to the base each year. If the new facility were not exempt, this tax base would instead go to the State. However, based on the current law, at least $7.8 million per year of the tax yield would be returned to the county, which would also be a large beneficial impact.

4.5.3.3 Summary of Social and Economic

Based on the information provided by SERI, staff interviews with local public officials, and their own independent review of data on the regional economy and taxes, the staff concludes that the impacts on the regional economy of constructing the new unit or units at the Grand Gulf ESP site on most of the region would be SMALL, with a possible MODERATE beneficial impact in Warren County. Under current Mississippi tax law, it appears that Claiborne County would receive property taxes or payments in lieu of taxes that in the last year of construction would approach at least an increase of $7.8 million (83 percent of the current county budget) and perhaps much more, depending how the new plant would be treated for tax purposes. Taken together with the jobs created in the region, this would be a LARGE beneficial impact.

The conclusion of LARGE beneficial impacts by the NRC was predicated on certain assumptions made by the staff; these include: that there would be no more than 3150 new construction workers at the Grand Gulf ESP site, that no less than 50 percent of these workers would come from the 80-km (50-mi) region surrounding the site, that new workers would tend to live in the larger communities in the region, and that there are no significant changes in Mississippi tax law, especially the terms and conditions for taxability of real property. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there would be any new and significant information that would change this conclusion.

4.5.4 Infrastructure and Community Services

Infrastructure and community services include transportation, recreation, housing, public services, and education.

4.5.4.1 Transportation

Most of the larger pieces of equipment or structures and bulk materials would probably be brought to the site by barge. However, the transport of such large pieces of equipment would be an infrequent occurrence. No adverse impact on existing railway service in the area would occur from new facility construction activities at the Grand Gulf ESP site. The nearest active, regularly used railroad is operated by Kansas City Southern, which has freight train service that passes within 45 km (28 mi) northeast of the site. No new rail service is planned to support materials deliveries and new facility construction activities although it was not excluded (SERI 2004d) and may be necessary (SERI 2005).

The number of traffic accidents on Grand Gulf Road increased during the construction of GGNS Unit 1. In the 4 years preceding construction (1971 to 1974), the average number of traffic accidents on Grand Gulf Road was five per year. During construction (1975 to 1978), an average of 30 accidents per year occurred on Grand Gulf Road. Traffic counts conducted during the construction of the GGNS Units 1 and 2 (GGNS Unit 2 was not completed) indicated the roadways were not overloaded. Temporary traffic overloads were reported during morning and evening shift changes (SERI 2005). Combined with regular daily traffic to the existing GGNS Unit 1 facility, the large volume of construction workers could put stress on the existing road net.

Improvements were made to local roads and bridges leading to GGNS during construction of the existing facility. It should be noted that U.S. Highway 61, now a four-lane highway, was a two-lane highway from Vicksburg to Port Gibson and south to Natchez during the GGNS Units 1 and 2 construction peak. Although traffic was heavy during the morning and evening commutes, the highway was adequate with only two lanes.

A highway construction project to extend State Highway 18 is in the advanced planning stages (Section 2.8.2.2). This proposed extension would connect State Highway 18 from Port Gibson to Grand Gulf Road near the site, providing additional access to the Grand Gulf ESP site (SERI 2004a). The section of U.S. Highway 61 from Natchez Trace Parkway south through Claiborne and Jefferson Counties to the Jefferson/Adams County line is currently being widened from two to four lanes (SERI 2004a). The sections of U.S. Highway 61 to the north and south of the proposed construction are already four lanes. Therefore, U.S. Highway 61 is expected to accommodate the increased traffic created by construction workers headed to the Grand Gulf ESP site (SERI 2004a). New road construction beyond this should not be necessary.

Table 4-1 shows current daily traffic counts and estimated hourly capacity of the primary roads in Claiborne County. The information shows the primary access routes, including Grand Gulf Road, have sufficient capacity to handle the projected increase in traffic resulting from the construction workforce for a new facility, which would be about 1100 vehicles per shift. This value is based on 3150 workers, divided into two shifts, with 300 workers living close by, and 20 percent of the workers carpooling (SERI 2005).

Based on the information provided by SERI, interviews, and the NRC staff's independent review, the staff concludes that the offsite impacts of construction of the new units on transportation could be managed so they would be small. No additional mitigative actions beyond those identified above appear to be warranted.

4.5.4.2 Recreation

A description of local tourism and recreation is provided in Section 2.8.2.4. The only access to Grand Gulf Military Park to the north of the Grand Gulf site is via Grand Gulf Road; therefore, increased traffic resulting from the transportation of machinery and the construction workforce would affect the traffic flow to Grand Gulf Military Park. This impact would be expected to occur during periods of heavy traffic, primarily in the morning and in the evening when shift change takes place and generally only during the week (SERI 2005). The majority of visitors frequent the Grand Gulf Military Park on the weekends. The effect on the recreation experience (access, aesthetics) at Grand Gulf Military Park would be temporary because construction activities are temporary. The overall impacts of construction on recreation would be small.

Table 4-1. Road Analysis in Claiborne County

Primary Route	Roadway Description and Improvements	Average Daily Traffic Count (vehicles/day)	Estimated Roadway Capacity (vehicles/hour)
Grand Gulf Nuclear Station to U.S. 61	2-lane Grand Gulf Road - no significant changes	940 to 1100	1100
U.S. 61 N to Vicksburg	U.S. 61 between Port Gibson and Vicksburg is a modern 4-lane, divided freeway	6800	1900 per lane (total 3800 for 2 northbound lanes)
U.S. 61 N and MS 462 E to Vicksburg	MS 462 re-paved and re-signed - added a span in the Kennison Creek bridge	600	1300
MS 18 W to Utica	MS 18 was re-paved in 2002 and brought up to MDOT standards with 12-foot wide lanes	2500	1300
MS 547 E to Hazelhurst	MS 547 re-surfaced in 2002	2900	1300
MS 552 S to U.S. 61 S to Natchez	MS 552 S is a 4-lane divided freeway from Alcorn State University to U.S. 61 S	360, then 2800 South of Alcorn	1900 per lane (total 3800 for 2 southbound lanes)
Westside to U.S. 61 S to Natchez	U.S. 61 S is a 2-lane improved roadway - will be a 4-lane, divided freeway within 2 years like U.S. 61 N from Port Gibson	No MDOT data available for Westside Rd. - U.S. 61 S is 5500	>1400
MS 552 S to U.S. 61 S to Natchez	MS 552 S is a 4-lane divided freeway from Alcorn State University	2800	3800 for 4-lane freeway
	U.S. 61 S is a 2-lane road	5500	1900 for U.S. 61 S

MDOT = Mississippi Department of Transportation
MS = Mississippi State (Highway)
Source: SERI 2005

4.5.4.3 Housing

If the entire construction workforce of 3150 originated within 80 km (50 mi) of the Grand Gulf ESP site, there would be no impact on housing demand. However, based on prior experience with projects of similar size, up to 50 percent of the workforce could come from beyond the 80-km (50-mi) region (SERI 2005). Most, if not all, of these workers from outside the region would be expected to relocate to the region at least during the work week. If up to 1600 workers were to come from outside the region, there would be a demand for up to that many housing units, mainly apartments, although some single-family residences might be required if construction workers decide to relocate with their families. A review of the vacant housing available in the year 2000 (Section 2.8.2.5) shows enough vacancies in the region to absorb the in-migrating construction workforce. Claiborne County has seen relatively limited new housing and slow price increases in the last five years (Section 5.1.1). Only small numbers of units would be expected to be available in Claiborne County.

Some relocated construction workers might bring mobile homes for the duration of their employment. SERI's environmental report assumed about 300 workers would live in nearby manufactured home parks (SERI 2005). If this is the case, an influx of construction workers into the local area could compete with recreational users for spaces at existing manufactured home and recreational vehicle parks. Alternatively, if the incoming construction force were to generate demand for additional private manufactured home and/or recreational vehicle parks, this demand could lead to an increase in spaces being made available. If, for example, the same percentage of in-migrating construction workers were to choose Port Gibson as a residence as has the current workforce (14.6 percent see Table 4-2), the construction workers would need 230 local housing units, equal to about twice the vacant housing stock in the city at the 2000 U.S. Census (USCB 2004). However, SERI believes as many as 300 construction workers might live in manufactured homes or recreational vehicle parks near the site (SERI 2005). If construction workers concentrate in the county, the impact on the local Claiborne County rental housing market could be moderate. A similar situation might prevail in Fayette in

Table 4-2. Potential Increase in Resident Population Resulting from Construction at the Grand Gulf Early Site Permit Site

Jurisdiction	Percent of Current Workforce by Location	Facility-Related Increase in Population	Year 2000 U.S. Census Population	Percentage Increase	Facility-Related Households	Year 2000 Vacant Housing Units
Vicksburg	46.4	2925	26,407	11.1	731	1290
Port Gibson	14.6	918	1,840	49.9	230	95
Other Locations:						
Clinton	7.3	459	23,347	2.0	115	571
Fayette	3.9	243	2,242	10.8	61	68
Natchez	3.3	207	18,464	1.1	52	888
Brookhaven	2.7	171	9,861	1.7	43	430
Jackson	2.7	171	184,256	0.1	43	7837
Wesson	2.3	144	1,693	8.5	36	41
Hazelhurst	1.7	108	4,400	2.5	27	158
All Other:	15.1	951	NA	NA	239	NA
Total	100	6300			1577[a]	

(a) Difference from 1575 in SERI (2005) due to rounding.
Source of Resident Locations: SERI 2004a
Source of Year 2000 U.S. Census Population: USCB 2004

Jefferson County, but the impact likely would be minimal in the surrounding counties, which have larger housing markets and most likely would experience a smaller influx of workers. If, as expected, many of the in-migrating construction workforce live in larger towns and cities of the region, then the impacts on housing would be small.

4.5.4.4 Public Services

This section describes the public services available and discusses the impacts of construction at the Grand Gulf ESP site on water supply and waste treatment, police, fire and medical services, and social services in the region.

Water Supply and Waste Treatment

A detailed description of construction-related water requirements and the impact is presented in Section 4.3.1 of this document. According to the SERI environmental report, construction activities for the existing GGNS Unit 1 required approximately 1,900,000 L/d (500,000 gal/d) of water for concrete batch plant operation, dust suppression, and sanitary needs (SERI 2005). It is anticipated that construction of a new facility would require at least this quantity of water. The amount of water used for construction of a new facility may be reduced if portable toilet facilities are used for sanitary needs. The recommended planning number for potable water consumption for workers in hot climates is 11 L/d (3 gal/d) for each worker (EPA 1997). Based on the maximum construction worker population of 3150 workers, the potable water consumption is estimated at 35,770 L/d (9450 gal/d). Three wells completed within the Catahoula Formation are currently used to supply water for general site purposes. Two of these wells are in routine use, and the third well is a backup. During GGNS Unit 1 refueling outages, the two wells operate at near full capacity. Therefore, these existing wells would not have adequate production to supply the continuous construction water needs for a new facility, and the installation of an additional well or wells would likely be required for construction purposes. SERI did not expect that the new wells, with the capacity to supply the above construction needs, would have any significant impact on the local aquifer or on offsite water users (SERI 2005). The staff determined that not enough information is available to support this conclusion (see Section 4.3.2). However, if later information shows that the Catahoula formation in the vicinity of the Grand Gulf ESP site is not able to support additional wells without adverse impact, the staff concluded that the facility could instead use treated Mississippi River water, which would minimize the impact on offsite users.

Because the new facility, like GGNS Unit 1, would use an independent onsite water supply and water and sewer treatment facilities, Port Gibson water and sewer services would not be burdened by construction of a new facility at the Grand Gulf ESP site. The short-term influx to the area of a construction-related population (workers and their families) of as many as

6300 persons (one-half the expected number of construction workers, times four persons per household) would not be expected to over-burden local sewer and water utilities in surrounding communities because the construction workforce would be spread over a large geographic area. The commuting construction workforce would commute from the surrounding Mississippi counties but would likely concentrate in larger population centers such as Vicksburg, Natchez, and Clinton/Jackson because of the services available in these developed, more populous areas.

Water and sewer availability and capacity information obtained from the Mississippi Development Authority was reviewed for the communities of Vicksburg and Jackson, Mississippi. The current water consumption in the community of Vicksburg is below the reported capacity. The water and sewer services in Vicksburg are currently at 70 percent of total capacity (SERI 2004a). Municipal water and sewer services in Jackson are reported at 85 percent of total capacity (SERI 2004a). Based on utility capacity information for the communities of Vicksburg and Jackson, cities typical of the population centers that would be utilized by construction workers, the influx of construction workers would not overburden public utilities in surrounding communities. Costs incurred by local utilities for increased water use and sewer treatment supplies would be offset by revenues paid by the new users and by increased commercial retail demand and by property, sales, and income tax revenues generated by the in-migration of construction workers. In Port Gibson, where water use is 34 L (90 gal) per capita per day (USGS 2005), the potential increase of 918 residents would increase demand by 313,000 L/d (82,600 gal/d), close to the excess capacity of the local water system. The impact on water and sewer systems could, therefore, be significant.

Police, Fire, and Medical

The temporary increase in the construction workforce and the construction operations for a new nuclear facility can increase the burden on local fire and police departments. The impact on any one community would be minimized by the dispersal of the construction workforce in the more populous areas of surrounding communities. The impact on the local police and fire departments could result in the need for local communities to hire additional police or fire department staff, buy additional vehicles, build new facilities, and improve existing facilities. The additional tax revenues from the influx of construction staff would, in part, help offset the cost to expand local police and fire departments. The impact would further be offset by the benefits provided to local residents because of improvements in public safety departments and in increased employment in these departments. There are significant local concerns that the current tax structure, which provides a fixed dollar amount to Claiborne County from taxes on GGNS Unit 1, will not provide enough funds to offset the increased demand on local public resources, which would lead either to local tax increases, a deterioration in service, or both (Scott 2004).

Eleven hospitals with a total capacity of about 3000 hospital beds are located in Claiborne and the surrounding Mississippi counties. It is expected that minor injuries to construction workers can be treated or assessed by onsite medical personnel and supplies. Other injuries would be treated at one of eleven hospitals located in the contiguous Mississippi counties, depending on capacity and ability to treat specific injuries. Detailed information concerning the capacity of the hospitals in Claiborne County and the adjacent Mississippi counties is provided in Section 2.8.2.6 of this document. Specific agreements have been established with local medical care suppliers to support emergency planning (SERI 2005). It is expected that these arrangements would be updated to support the new facility. A new medical center has recently been constructed in Vicksburg (56 km/35 mi from the site on Highway 61 North) with a full range of major medical capability. It is anticipated that Port Gibson Hospital would accept construction injuries. However, more serious injuries would be routed to medical centers more capable of handling severe injuries, including River Regional Medical Center and Parkview Hospital (SERI 2005). Based on the size and availability of medical services in Claiborne and especially the immediate surrounding counties, the temporary construction workers would not overburden existing medical services.

Social Services

Under the assumption that the construction workforce would come from the region, the main social impact of the proposed construction would be most related to the transportation network in the vicinity of the Grand Gulf ESP site. If it is assumed that workers who relocate would settle in the more urban nearby communities of Vicksburg, Natchez, and Jackson, Mississippi, then the relative social impact of such an in-migration to these areas would not be noticeable, given the population of the areas. Overall, the impact of construction on social services should be small.

Summary of Public Services

SERI stated that it expects only about half of the construction workforce to come from outside the region, and it is likely that in-migrating workers would choose to live in the larger cities of the region and would, therefore, have a dispersed effect on public services. Although some water and sewer systems are reaching capacity, it is likely that they would have to be expanded anyway to meet normal growth. While there are limited police, fire, and medical facilities in the vicinity of the plant, the cooperative operational linkages between many of the local governments provides a considerable backup capability. Taken together, the impacts on public services likely would be small.

4.5.4.5 Education

Assuming that 3150 construction workers would be required for a new nuclear power plant at the Grand Gulf ESP site, and if the construction-related population increase of 6300 distributed itself in the same way as the current GGNS-related population, the impacts could be considerable in Port Gibson, which could experience an increase of 460 children (230 households times two students per household) in a district that has only 2011 total students (see Table 2-18). In that case, the impacts of building and staffing additional school facilities likely would be moderate, assuming some level of State impact assistance. However, if, as expected, most of the construction workforce lives outside of Claiborne County, the other school districts in the region likely to receive students are larger than Port Gibson or have sufficient capacity planned to absorb the potential increases in enrollment related to construction. The impacts on these other districts likely would be small (Scott 2004).

4.5.4.6 Summary of Infrastructure and Community Services

Based on information supplied by SERI, staff interviews conducted with public officials in Claiborne, Jefferson, and Warren counties, and staff review of data concerning the current availability of services and current state and community planning efforts, the staff concludes that the construction impacts on the regional infrastructure and community services would be SMALL in most of the region. The estimated workforce of 3150 would have a SMALL effect on the transportation network in the vicinity and region because several permanent transportation mitigation measures are being implemented that will remove most remaining bottlenecks. The site is relatively isolated, industrial in nature, and well masked by forest in most directions so the impacts on aesthetics would be SMALL, as would the impacts on recreation. The impacts on public services and infrastructure would be SMALL throughout the region, unless Claiborne County draws a substantial share of the in-migrating construction workforce, which is not expected. In that case, the impacts on housing and education in Claiborne County could be MODERATE.

The conclusion of MODERATE impacts by the NRC was predicated on certain assumptions made by the staff; these include: that there would be no more than 3150 new construction workers at the Grand Gulf ESP site, that no less than 50 percent of these workers would come from the 80-km (50-mi) region surrounding the site, that new workers would tend to live in the larger communities in the region (but could still result in a significant relative increase of population in Claiborne County), and that the state would provide some financial help if the school system were seriously affected by in-migration. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there would be any new and significant information that would change this conclusion.

4.5.5 Summary of Socioeconomic Impacts

Based on information supplied by SERI; staff interviews conducted with public officials in Claiborne, Jefferson, and Warren counties; and the current availability of services and additional taxes that would likely compensate the need for additional services, the staff concludes the construction impacts on the local economy would be beneficial and SMALL in most of the region and probably MODERATE in Warren County (Vicksburg). The effect on tax revenues would be beneficial and SMALL, except for property tax receipts in Claiborne County, which would be LARGE and beneficial. The impacts on transportation would be SMALL. The site is relatively isolated, industrial in nature, and well masked by forest in most directions so the impacts on aesthetics would be SMALL, and the impacts on recreation would be SMALL as well. The impacts on public services would be SMALL throughout the region, unless Claiborne County draws a substantial share of the in-migrating construction workforce, which is not expected. In that case, the impacts on housing and education in Claiborne County could be MODERATE. The overall range of impacts on infrastructure and community services would be SMALL to MODERATE.

Given the assumptions made in the previous subsections, the staff concludes that the overall tax benefit would be much larger than any adverse impacts and the net socioeconomic impact would be LARGE and beneficial. These conclusions are predicated on a number of assumptions made by the applicant and the staff. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there is any new and significant information that would change these conclusions.

4.6 Historic and Cultural Resource Impacts

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The National Historic Preservation Act of 1966 (NHPA), as amended, also requires Federal agencies to consider the impact on those resources if they are eligible for listing on the National Register of Historic Places (such resources are referred to as “Historic Properties” in the NHPA). As outlined in “Coordination with the National Environmental Policy Act,” 36 CFR 800.8, the NRC is coordinating compliance with Section 106 of the NHPA in meeting the requirements of NEPA.

The NRC determined that construction, operation, and decommissioning of new nuclear units at the Grand Gulf ESP site is an undertaking that could possibly affect either known or potential historic properties. Therefore, in accordance with the provisions of the NHPA and NEPA, the NRC is required to make a reasonable and good-faith effort to identify historic properties in the areas of potential effect and, if present, determine if any significant impact is likely to occur. Identification is to occur in consultation with the State Historic Preservation Officer, American Indian Tribes, interested parties, and the public. If significant impact is possible, efforts should be made to mitigate it.

To determine if significant archaeological and historic resources have been identified or may exist at the Grand Gulf ESP site, the NHPA Section 106 process is being integrated with the NEPA process, in accordance with 36 CFR 800.8. As part of this integration, an Area of Potential Effect, that is, the area within which cultural and historical sites could be affected by the proposed nuclear facility construction, was defined as

> ...the area at the power plant site and its immediate environs which may be impacted by land-disturbing activities associated with the construction and operation of the new unit(s) and construction of new transmission lines that may follow parallel with some of the existing transmission line systems now serving GGNS (NRC 2004q).

As part of the NEPA/NHPA integration, the NRC initiated consultation with the Advisory Council on Historic Preservation (NRC 2004q), the Mississippi Department of Archives and History (NRC 2004r), the Mississippi Band of Choctaw Indians (NRC 2004s), the Choctaw Nation of Oklahoma (NRC 2004t), and the Tunika Biloxi Indian Tribe of Louisiana (NRC 2004u). A public scoping meeting on the proposed project was held on January 21, 2004. See Section 2.9.3 of this document for additional information on these efforts.

Prior to defining the Area of Potential Effect, consideration was given to including the Grand Gulf Military Park, located adjacent to GGNS Unit 1 site, in the Area of Potential Effect because of possible visual effects from the proposed cooling tower. The park was not included because the cooling tower would not be visible from the main portions of the park. This was confirmed by an onsite visit on April 14, 2004, and discussions with park personnel (Stapp 2004).

The Area of Potential Effect includes the areas where new facilities and associated infrastructure are planned, including all areas where construction laydown yards may be located. Because laydown yards and, in some cases, associated infrastructure have yet to be determined, the Area of Potential Effect is the current Grand Gulf site boundary (see Figure 2-1). Disturbed areas within the Area of Potential Effect are considered because the extent of disturbance in many areas is not known. Previous laydown yards, for example, are clearly disturbed at the surface, but that disturbance may be relatively shallow. Some areas, primarily the area around the weather station and adjacent to Grand Gulf Mound (22-Cb-522) were farmed previously, causing significant disturbance within the plow zone. However, undisturbed deposits exist below the plow zone.

Within the Area of Potential Effect, previous cultural resource efforts have identified the presence of several archaeological sites and the potential for additional sites, as explained in Section 2.9 of this document. None of the known sites, however, are considered significant, and most are generally located away from the areas targeted for new construction. The Mississippi Department of Archives and History has identified two areas of the site where cultural resource surveys should be conducted if they are selected for construction “due to the possibility that unrecorded sites may exist” (see Figure 4-1) (SERI 2005). If these areas are selected, prior to construction these areas will be further investigated using appropriate methods such as tilling, survey, and shovel testing.

As indicated in Section 2.9.2 of this document, the Callendar House and the segment of the Grand Gulf and Port Gibson Railroad bed are not considered significant and are not located in areas planned for construction. Also, literature reviews and consultations with regional Native American tribes have not identified any traditional cultural properties in the vicinity of the proposed ESP construction area.

No analysis of cultural and historic resources was conducted for the transmission line rights-of-way. The full extent of potential land-use impacts in the transmission line rights-of-way can be estimated only after following the Federal Energy Regulatory Commission process for connecting new large generation to the grid. This process is detailed more specifically in Section 3.3. Once this process is completed, the appropriate cultural resources studies would be undertaken to ensure that resources are identified and addressed prior to construction.

In addition to assessing the known and potential occurrence for cultural resources, SERI would include cultural resource-specific written directions in their site-wide Excavation and Backfill Work Procedures, which would call for an immediate stop-work order should archaeological, historical, or other cultural resources be uncovered during excavation. The construction supervisor would be responsible for ensuring the work stoppage and for notifying the Environmental Compliance Coordinator of an inadvertent discovery. In the event that an inadvertent discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would consult with them in conducting an assessment of the discovery to determine if additional work is needed.

The NRC staff concludes, based on the cultural resource analysis and consultation, that the potential impacts on historic and cultural resources would be SMALL. The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include the commitment made by SERI to develop procedures to provide immediate reaction and notification in the event of inadvertent discovery of cultural resources and to conduct surveys prior to construction of new transmission lines and areas identified in Figure 4-1. The procedures will be included in the site-wide Excavation and Backfill Work Procedures and will involve an immediate stop work order should archaeological, historical, or

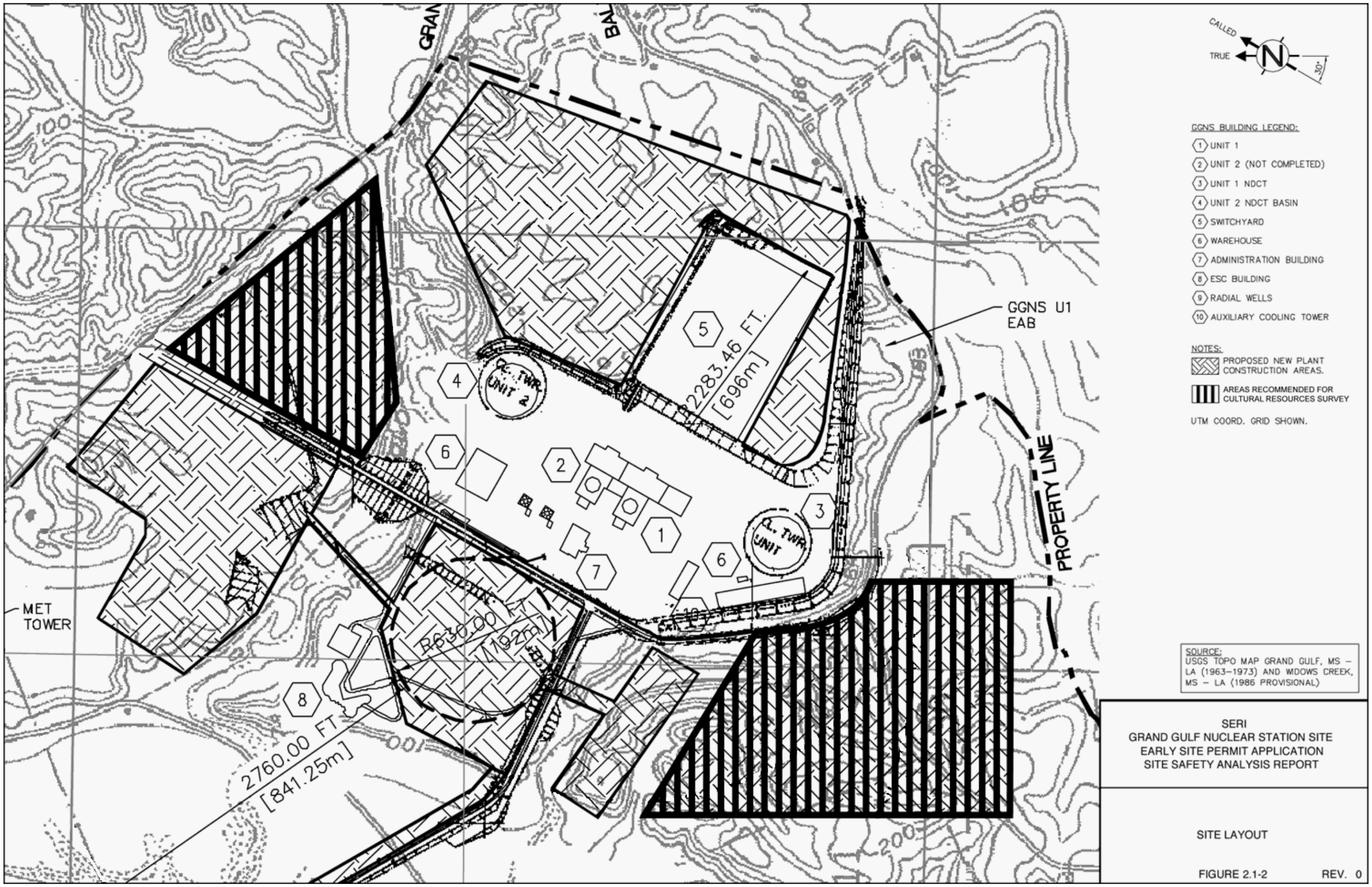

Figure 4-1. Map of Grand Gulf Site Showing Proposed Construction Areas and Locations Recommended by Mississippi Department of Archives and History for Cultural Resources Survey if Selected for Construction (adapted from SERI 2005, Figure 2.2-1)

other cultural resources be uncovered during excavation. The construction supervisor would be responsible for ensuring the work stoppage and for notifying the Environmental Compliance Coordinator of an inadvertent discovery. If such a discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would consult with him or her in conducting an assessment of the discovery to determine if additional work is needed. If an applicant submits a CP or COL application referencing this ESP, the NRC staff's review of such an application would be a separate undertaking requiring further consultation pursuant to Section 106 of the NHPA.

4.7 Environmental Justice Impacts

Environmental justice refers to a Federal policy under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040). Figures 2-12 and 2-13 in this document show the locations of minority and low-income populations around the Grand Gulf ESP site and within 80 km (50 mi) of the site.

The pathways through which the environmental impacts associated with the construction of new units at the Grand Gulf ESP site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

4.7.1 Environmental Impacts

Based on information provided by SERI and the NRC staff's independent review, the staff concludes that construction of new units at the Grand Gulf ESP site would not result in disproportionate and adverse offsite environmental impacts on minority and low-income populations and that mitigation is not warranted.

The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include no significant demographic changes before any additional units are added to the Grand Gulf site, and no significant resource dependencies or pre-existing conditions among the minority and low-income population that have not been identified.

4.7.2 Socioeconomic Impacts

Potential adverse socioeconomic impacts during construction of a new facility include potential adverse impacts on aesthetics, schools, transportation, public safety, social services, public utilities, and recreational resources. However, impacts during the construction period would be temporary, and are judged not to be significant. Facility construction, including temporary construction areas, would be accomplished within the boundaries of the current GGNS Unit 1 site. No additional land must be procured beyond the current site, and no relocations or major alterations to local offsite roads as a result of construction of a new facility would be expected.

A LARGE beneficial socioeconomic impact, principally on Claiborne County through its tax base and a MODERATE beneficial impact on the larger Mississippi communities surrounding the site through increased employment opportunities, could be realized by the construction of a new facility at the Grand Gulf ESP site. Construction would increase employment opportunities, both directly and indirectly, for workers within the region of the proposed Grand Gulf ESP site, and increase tax revenues. See Section 2.8 of this document for additional discussion of special provisions for tax payments made directly to Claiborne County in recognition of its role as host county to the site. If additional tax payments and planned infrastructure improvements are not made to Claiborne County to compensate for the additional burden of construction traffic and possible new residents, the staff concludes that the socioeconomic burden on local taxpayers (largely minority, and a majority of whom are low income) may be adverse, disproportionate, and MODERATE.

The range of impacts estimated by the NRC is predicated on certain assumptions made by the staff. These include no significant demographic changes before any additional units are added to the Grand Gulf site, no changes to the terms and conditions for taxability or real property under Mississippi tax law, not more than 3150 construction workers would be employed at the Grand Gulf ESP site, not less than 50 percent of the construction workers come from the region within 80 km (50 mi) of the Grand Gulf ESP site, and most workers would choose to live in the larger cities of the region.

4.7.3 Summary of Environmental Justice Impacts

Taken together, the impacts of plant construction on environmental justice would be SMALL for environmental impacts because no environmental pathways or preconditions of the minority and low-income population were found that would lead to adverse and disproportionate impacts. The socioeconomic impacts could range from LARGE beneficial to MODERATE adverse because local tax burdens and access to public services in Claiborne County could either greatly improve or significantly deteriorate, depending on the level of public sector obligations imposed by new residents and the level of tax revenues provided by the new units.

The conclusion of LARGE beneficial to MODERATE adverse impacts by the NRC staff is predicated on certain assumptions made by the staff. These include not more than 3150 construction workers would be employed at the Grand Gulf ESP site, not less than 50 percent of the construction workers come from the region within 80 km (50 mi) of the Grand Gulf ESP site, most workers would choose to live in the larger communities in the region, there are no significant changes in the terms and conditions for taxability of real property under Mississippi tax law, and regional populations of minority and low-income populations will remain in the same geographic locations. The specific level within the wide range of possibilities depends largely on to what extent the local communities have access to the tax base represented by the new units. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there is any new and significant information that would change these conclusions.

4.8 Nonradiological Health Impacts

In the environmental report (SERI 2005), SERI indicated that the physical impacts associated with construction at the ESP site may include dust, smoke, engine exhaust, and concrete operations as sources of air pollution during construction of the new nuclear unit(s). The area around the Grand Gulf ESP site is predominantly rural with a population in 2002 of approximately 7250 people within a 16-km (10-mi) radius of the site. No significant industrial or commercial facilities are located or planned in this area. The following sections discuss the results of the staff's assessment of nonradiological health impacts for the Grand Gulf ESP site.

4.8.1 Public Health and Occupational Health

SERI stated in the environmental report (SERI 2005) that the public would not be close to the construction site and, therefore, it is unlikely that physical impact would be considered more than an annoyance or nuisance. No one lives within 300 m (1000 ft) of the site. In addition, the impact would be temporary. It is not expected that fugitive dust emissions or noise from construction equipment would reach local residents.

The staff expects construction workers and personnel working onsite to be exposed to fugitive dust, gaseous effluents, and noise resulting from construction activities. Operational controls would be imposed to mitigate dust, such as wetting unpaved roads and construction areas. Cleared areas would be mulched or seeded to reduce wind-blown dust. The concrete facility would be equipped with dust-control systems to minimize releases of concrete dust (SERI 2005). To prevent excessive exhaust emissions, construction equipment that uses gasoline or diesel fuel would be inspected and repaired or replaced routinely.

In general, human health risks for construction workers and personnel working onsite are expected to be dominated by occupational injuries (e.g., falls, electrocution, and asphyxiation) to workers engaged in activities such as construction, maintenance, and excavation. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. Occupational injury and fatality risks are reduced by adherence to NRC and Occupational Safety and Health Administration (OSHA) safety standards, practices, and procedures. Appropriate State and local statutes must also be considered when assessing the occupational hazards and health risks associated with construction. The staff assumes adherence to NRC, OSHA, and State safety standards, practices, and procedures during construction activities.

The staff reviewed the information in the SERI environmental report and concludes that nonradiological health impact on the site preparation and construction workers and local population would be SMALL, and additional mitigation would not be warranted.

4.8.2 Noise Impacts

Large construction projects involve many noise-generating activities. Regulations governing noise from construction activities are generally limited to worker health. Federal regulations governing construction noise are found in 29 CFR Part 1910 and 40 CFR Part 204. The regulations in 29 CFR Part 1910 deal with noise exposure in the construction environment, and the regulations in 40 CFR Part 204 generally govern the noise levels of compressors.

Activities associated with construction of a new nuclear power facility at the Grand Gulf ESP site would generate noise levels typical of larger construction projects. The PPE indicates that maximum construction noise would be between 76 and 101 dBA at a distance of 15 m (50 ft) from the source (SERI 2005). Noise levels for common construction activities are typically about 90 dBA at a distance of 3 m (10 ft). At 30 m (100 ft), the noise level would be about 70 dBA, and at a distance of 300 m (1000 ft), the noise level would be 50 dBA. A 10-dBA decrease in noise level is generally perceived as cutting the loudness in half. A few activities, such as jack hammers, have noise levels of about 110 dBA. The staff estimates that a 110-dBA noise level for a jack hammer would be reduced to about 70 dBA at 300 m (1000 ft) and would be even lower at the nearest residence.

Many of the construction activities at the Grand Gulf ESP site would take place near the existing GGNS Unit 1. Therefore, the potential for loud noises exists near the Unit 1 workforce. However, most of the workforce work indoors, which will reduce their exposure. For those Unit 1 workers who will be outside, training and noise protection would be provided. If it is necessary to do any blasting, the activity would be performed during the day to be less distracting to the local population.

4.8.3 Summary of Nonradiological Health Impacts

The staff reviewed the information in the SERI environmental report (SERI 2005) and concludes that nonradiological health impacts on construction workers, workers at the current GGNS Unit 1 facility, and the local population from fugitive dust, occupational injuries, and noise would be SMALL, and additional mitigation would not be warranted.

4.9 Radiological Health Impacts

The sources of radiation exposure to site preparation and construction workers include direct radiation and gaseous radioactive effluents from GGNS Unit 1 during the site preparation and construction phase. Exposure to liquid radioactive waste discharges is expected to be negligible. SERI (2005) noted that all major construction activities are expected to occur outside of the GGNS Unit 1 protected area boundary but inside the restricted site boundary (exclusion area).

4.9.1 Direct Radiation Exposures

In its environmental report, SERI (2005) identified two principal sources of direct radiation exposure from the GGNS Unit 1 facility. These sources are skyshine from the nitrogen-16 source from the main turbine steam cycle and exposure from the condensate water storage tank. A minor contributor to direct radiation would also be from airborne emissions released from the facility. The staff did not identify any additional sources of direct radiation during the site visit or during documentation reviews.

In its environmental report, SERI (2005) estimated direct radiation exposure to workers from measurements taken from thermoluminescent dosimeters (TLDs) used in the radiological environmental monitoring program (REMP). These TLDs are located on an inner ring around the general area of the GGNS boundary, at the protected area boundary surrounding the facility, and on an outer ring located approximately 4.8 to 8 km (3 to 5 mi) from the site (SERI 2005). SERI used the data from the *2001 Annual Radiological Environmental Operating Report* (Entergy 2002b). The TLDs are read quarterly. SERI compared data for the years 1999 through 2002 and determined that the data for 2001 were representative for the site for the purposes of the ESP evaluation based on the average annual capacity factor of 93.6 percent for 2001 (SERI 2004d).

The location of the proposed power block and the normal heat sink cooling towers is west/northwest of the existing unit. The radiation levels measured by TLDs on the protected area boundary (at the protected area fence) in the west/northwest sectors are approximately 10 mrem per quarter, or essentially background, because the proposed construction site is beyond the protected area fence, the radiation levels at that location are also expected to be essentially background levels. Other proposed construction areas are located south and east of the operating unit, all more than 76 m (250 ft) beyond the TLDs on the protected area fence. SERI used the average reading of the 16 TLDs on the protected area fence (approximately 0.375 mSv [37.5 mrem] per quarter) to determine the average dose rate for all areas proposed for new construction. Based on an occupational exposure period of 2080 hours per year, the dose rate of 0.375 mSv (37.5 mrem) per quarter would result in a dose to a worker of 0.36 mSv (36 mrem) per year. Because the areas proposed for new construction are all located beyond the protected area fence line, the dose rates in these areas will be lower than those measured at the fence line, due to the increased distance from the existing unit. Most of the construction effort would be west of the operating unit. The reading from TLDs located on the west/northwest side of the protected area fence are essentially background levels (averaging approximately 0.1 mSv (10 mrem) per quarter). Proposed construction activities are planned east of the operating unit, where the protected-area-fence TLDs have higher readings. However, these activities would take place over 76 m (250 ft) beyond the protected area fence, resulting in lower dose rates than indicated by the protected-area-fence TLD readings.

SERI maintains that the direct-dose contribution from shyshine from nitrogen-16 and exposure from the condensate water storage tank would be accounted for in the protected-area-fence TLD readings. The annual site construction workforce dose is estimated to be 1.12 person-Sv (112 person-rem) (SERI 2005), based on an assumed construction workforce of 3150. Adjustments for background dose were not made for the assessment of dose to the workers.

The staff's evaluation included a review of the proposed construction areas and recent records of dose rates, the locations of the TLDs, and the procedure used for estimating doses to members of the public in controlled areas. Based on this review, the staff concludes that the method used to estimate doses to workers from direct radiation from the existing GGNS Unit 1 would be acceptable.

4.9.2 Radiation Exposures from Gaseous Effluents

Gaseous effluents from GGNS Unit 1 are released from four points: the radwaste building vent, the turbine building vent, the containment building vent, and the auxiliary building vent. The maximum total body dose rate from airborne releases for 2001 was 0.0013 mSv/yr (0.13 mrem/yr) based on data from the 2001 *Annual Radiological Effluent Release Report* (Entergy 2002a). SERI considers that, on an annual basis, the dose to workers from gaseous effluents would be insignificant (approximately 0.001 person-Sv or 0.1 person-rem) with respect to the dose from direct radiation and that this dose would be accounted for in the protected-area-fence TLD readings. This is based on an assumed construction workforce of 3150 persons and an occupational exposure period of 2080 hours per year.

The staff reviewed the data from the 2001 *Annual Radioactive Effluent Release Report* (Entergy 2002a) and from more recent years and found that 2001 data were typical of effluents in recent years. The staff also determined that the method for estimating dose from gaseous effluents was acceptable.

4.9.3 Radiation Exposures from Liquid Effluent

Liquid effluents from GGNS Unit 1 are combined with the cooling tower blowdown in the discharge basin and released to the Mississippi River at the existing barge slip. Any of the construction activities for the new facility would be upstream from the release point of the current plant. For 2001, the maximum individual whole body dose from liquid effluent was calculated to be 0.00018 mSv/yr (0.018 mrem/yr). SERI considers that, on an annual basis, the dose to site preparation and construction workers from liquid effluents would be insignificant (approximately 0.0006 person-Sv/yr (0.06 person-rem/yr)) with respect to the dose from direct radiation.

The staff reviewed the data from the 2001 *Annual Radioactive Effluent Release Report* (Entergy 2002a) and from more recent years and found that 2001 data were typical of effluents in recent years. The staff also determined that the method for estimating dose from liquid effluents was acceptable.

4.9.4 Total Dose to Construction Workers

SERI (2005) estimated an annual dose to a construction worker of 0.36 mSv (36 mrem) from the direct radiation pathway. Doses from liquid and gaseous releases are negligible compared to the dose from direct radiation. This estimate is well within both the dose limit to the public found in 10 CFR 20.1301 and occupational dose limits to construction workers found in 10 CFR 20.1201. The maximum estimated annual collective dose to workers, based on an annual individual dose of 0.36 mSv (36 mrem) and an estimated workforce of 3150 workers, is 1.12 person-Sv (112 person-rem). This compares to the approximately 9.5 person-Sv (950 person-rem) the workers would receive from natural background radiation (i.e., 3150 workers times 3 mSv/yr (300 mrem/yr)) (NCRP 1987). The annual dose limit to an individual member of the public is 1 mSv (100 mrem) total effective dose equivalent and less than 0.02 mSv (2 mrem) in any 1 hour. The annual occupational dose limit is 0.05 Sv (5 rem) total effective dose equivalent.

4.9.5 Summary of Radiological Health Impacts

Having reviewed SERI's estimate of dose to workers during site preparation and construction activities, the staff found the doses to be well within NRC exposure limits designed to protect the public health, even if workers exceed the 2080 hour per year occupancy factor. Assuming the location of the proposed new nuclear unit or units does not change, the staff concludes that the impact of radiological exposures to site preparation and construction workers would be SMALL, and mitigation is not warranted. At the CP or COL stage, the staff will verify that the location of the new unit(s) is/are in the location proposed in the ER.

4.10 Measures and Controls to Limit Adverse Impacts

The staff relied, in their evaluation of environmental impacts during construction activities for the proposed new units at the Grand Gulf ESP site, on SERI's compliance with the following regulatory requirements:

- Compliance with applicable Federal, State, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental impacts (for example, solid waste management, erosion and sediment control, air emissions, noise control, storm water management, spill response and cleanup, and hazardous material management)

- Compliance with applicable requirements of existing permits and licenses (for example, NPDES permit and operating license) for the existing unit and other permits or licenses required for construction of the new units

- Obtaining a permit from MDEQ and compliance with county ordinances if burning of construction materials is required

- Obtaining an NPDES permit related to accidental spills and storm water runoff.

The following plant species were not addressed in SERI's environmental report (SERI 2005), but were identified by the staff in Section 2.7.1.2 as plants to be avoided if they are documented in the area prior to construction: American bittersweet (*Celastrus scandens*), glade fern (*Diplazium pycnocarpon*), hairy waterclover (*Marsilea vestita*), and jug orchid (*Platythelys querceticola*).

In the event that a new nuclear power plant were constructed at the Grand Gulf ESP site, the staff assumed that local governments would need additional resources to provide public services–especially safety, medical, and schools.

SERI specifically identified the following general plans or specific mitigation measures in its environmental report (SERI 2005, Table 4.6-1) upon which the staff relied in its evaluation:

- Minimizing land cover impact by careful construction techniques and reclaim land disturbed by construction to the maximum extent possible (environmental report, Sections 4.1.1, 4.3.1, 4.4.1)

- Using standard noise protection and abatement procedures during construction. Provide hearing protection to onsite personnel if needed. Move excessively loud activities to daytime hours if necessary (environmental report, Sections 4.1.4, 4.4.1)

- Surveying areas prior to disturbance for archaeological resources, followed by data recovery, if necessary (environmental report, Section 4.1.3)

- Stabilizing embayment banks with riprap or other appropriate means during and following construction, and following requirements of ACE (environmental report, Sections 4.2.1, 4.2.2, 4.3.2)

- Implementing site-specific storm water pollution prevention plans; maintaining vegetative cover on land not in active construction; routing runoff to existing sedimentation basins, and monitoring discharges in accordance with NPDES and State water-quality standards and requirements (environmental report, Sections 4.2.1, 4.2.2, 4.3.2)

- Using tieback walls or similar control technology to limit effects of dewatering in accordance with applicable MDEQ regulations (environmental report, Sections 4.2.1, 4.2.2)

- Preventing contaminants from entering the aquatic system through use of a Spill Prevention Control and Countermeasure Plan (environmental report, Section 4.3.2)

- Segregating excavated topsoil for replacement in pipeline trench to allow wetland characteristics to be restored; confining construction to low-water periods to minimize disturbance of wetland soils; using low-weight construction equipment or operate from protective surfaces, and reseeding following construction (environmental report, Section 4.3.1)

- Modifying construction activities as necessary to avoid nesting or similar critical life history periods (environmental report, Section 4.3.1)

- Avoiding removal of isolated mixed hardwood-loblolly pine stand north of the switchyard (environmental report, Section 4.3.1)

- Avoiding areas where square-stemmed monkeyflower (*Mimulus ringens*) occurs, if documented prior to construction (environmental report, Section 4.3.1)

- Conducting surveys for species of special concern prior to construction activities (environmental report, Section 4.3.1)

- Controlling air emissions, if necessary, to meet requirements of applicable air regulations and onsite permits. Open burning would be done in burn pits in compliance with MDEQ regulations (environmental report, Section 4.4.1)

- Controlling dust by water spray, reseeding, and mulching, as necessary; equipping concrete batch plant with dust suppression equipment (environmental report, Section 4.4.1)

- Implementing flexible construction shifts and Unit 1 operation shifts to minimize impact on local traffic (environmental report, Section 4.4.2).

4.11 Summary of Construction Impacts

Table 4-3 shows the staff's impact level characteristics as SMALL, MODERATE, or LARGE as a measure of their expected adverse environmental impacts, if any. A brief statement in the "Comments" column explains the basis for the impact level. Some impacts, such as the addition of tax revenue for the local economies, are beneficial. The beneficial aspect is also reflected in the "Comments" column.

Impacts related to land use (site and vicinity, transmission line rights-of-way), water use, and terrestrial ecology were estimated for the purpose of comparison to alternatives, but are not resolved because significant information on the proposed action is lacking at the ESP stage. An applicant for a CP or COL that references the Grand Gulf ESP would need to provide this information to enable analysis at that time.

Table 4-3. Characterization of Impacts from Construction of One or More Nuclear Units at the Grand Gulf Early Site Permit Site

Category	Comments	Impact Level
Land-use impacts		--
Site and vicinity	Construction activities would take place within existing site boundaries.	Unresolved, likely to be SMALL
Transmission line rights-of-way	Additional capacity needed for full plant parameter envelope to be accommodated through upgrades of existing lines.	Unresolved, likely to be SMALL
Air quality impacts	Construction activities would be conducted in accordance with applicable Mississippi Department of Environmental Quality (MDEQ) requirements, and dust and emissions would be minimized through dust control measures.	SMALL
Water-related impacts		–
Hydrological alterations	Impacts would be localized and temporary. MDEQ and U.S. Army Corps of Engineers permit processes would minimize impacts.	SMALL
Water use	Construction would require minimal water use.	Unresolved, likely to be SMALL
Water quality	Construction would be conducted using best management practices to control spills and storm water runoff.	Unresolved, likely to be SMALL
Ecological impacts		--
Terrestrial ecosystems	Alterations to hardwood forest would be noticeable but not destabilizing.	Unresolved, likely to be MODERATE
Aquatic ecosystems	Construction impacts on aquatic resources would be temporary and spatially limited.	SMALL
Threatened and endangered species	Construction impacts on Federally listed and State-listed species and their habitat in the area would be minor.	SMALL

Table 4.3. (contd)

Category	Comments	Impact Level
Socioeconomic impacts		--
Physical impacts		SMALL
Workers/local public	Construction would take place within existing site boundaries, so impact on the public would be minimal. Impact on workers would be mitigated with training and protective equipment.	–
Buildings	Construction would not affect any offsite buildings, and onsite buildings were constructed to withstand vibration from construction activities.	–
Roads	Growth would put pressure on local road systems, but traffic control and management measures would protect any local roads during construction.	–
Aesthetics	Construction activities would be temporary and would occur on a site already occupied by a nuclear power facility.	–
Demography	Percentage of construction workers relocating to the region likely would be small relative to the existing population base unless concentrated in Claiborne County.	LARGE
Social and economic		LARGE Beneficial
Economy	Economic impact of construction overall would be beneficial to local economies.	–
Taxes	Degree of impact depends on the distribution of tax revenues to county or state; generally impact is beneficial, especially for property taxes. Under current tax laws, the beneficial impact of additional taxes would be large in Claiborne County.	–

Table 4.3. (contd)

Category	Comments	Impact Level
Infrastructure and community service		MODERATE
Transportation	Planned upgrades and traffic management plans would reduce temporary construction transportation impact.	–
Recreation	Visual impact of construction would be limited at the Grand Gulf Military Park.	–
Housing	Adequate housing is available in the greater Vicksburg area to handle construction workers. If workers concentrate in Claiborne County, the impact could be moderate.	–
Public services	Public services are adequate for any temporary influx of workers resulting from construction at the Grand Gulf ESP site.	–
Education	Adequate infrastructure exists to support the temporary influx of workers if they settle primarily outside of Claiborne County. If they settle in Port Gibson, however, impacts could be moderate.	–
Historic and cultural resource impacts	Proposed construction area is previously disturbed, and SERI would incorporate cultural resource protection directions in their site-wide excavation and backfill work procedures.	SMALL
Environmental justice impacts	Under current Mississippi tax law, adequate resources exist to accommodate changes required in Claiborne County.	LARGE Beneficial
Nonradiological health impacts	Emission controls and remote location of the proposed Grand Gulf ESP site would keep nonradiological health impacts small. Occupational health impacts related to construction would be within the bounds of other similarly sized construction projects.	SMALL
Radiological health impacts	Exposures would be below annual occupational and public dose limits.	SMALL

4.12 References

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29 CFR Part 1910. Code of Federal Regulations, Title 29, *Labor,* Part 1910, "Occupational Safety and Health Standards."

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5.0 Operation Impacts at the Proposed Site

This chapter examines the environmental issues associated with operation of one or more additional nuclear units at the proposed Grand Gulf early site permit (ESP) site for an initial 40-year period as described in the application for an ESP submitted by System Energy Resources, Inc. (SERI). As part of this application, SERI submitted an environmental report (SERI 2005a) that provides the plant parameter envelope (PPE) (see Appendix I) as the basis for the environmental review.

Sections 5.1 through 5.10 of this chapter discuss the potential impacts on land use, air quality, water, ecosystems, socioeconomics, historic and cultural resources, and environmental justice, as well as nonradiological and radiological health effects and impacts of postulated accidents. In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, the impacts have been analyzed, and, where possible, a significance level of potential impact – SMALL, MODERATE, or LARGE – has been assigned to each analysis. Measures and controls to limit adverse impacts of station operation during the initial 40 years are presented in Section 5.11. The staff's determination of significance levels is based on the assumption that the mitigative measures identified in the environmental report and in Section 5.11 of this environmental impact statement (EIS), or activities planned by various State and county governments as discussed throughout this chapter, such as infrastructure upgrades, are implemented. For issues that are considered to be resolved, the staff will verify the continued applicability of all assumptions used in its environmental analyses, should an applicant for a CP or COL reference the Grand Gulf ESP. These assumptions are listed in Appendix J.1. A summary of the operational impacts is presented in Section 5.12. The references cited in this chapter are listed in Section 5.13.

5.1 Land-Use Impacts

The land-use areas considered include those (such as the site, vicinity, area along transmission lines, and offsite areas) with the potential to be affected by operational activities. Operations of the ESP facility are not anticipated to require temporary or permanent changes of any current or planned land use.

5.1.1 Site and Vicinity

Operation of the proposed unit or units at the Grand Gulf ESP site would result in social and economic impacts that may translate into impacts on land use in the vicinity. These impacts are discussed in Section 5.5.2. A conservative estimate of the expected increase in population related to new personnel being employed at the ESP site would be 2320 persons. This assumes that all facility-related employment associated with the ESP site would relocate to the impact region (within 80 km (50 mi)) of the ESP site. Section 5.5.2 presents potential population impacts within individual jurisdictions, assuming relocations occur in proportion to the current distribution of worker residences.

The staff analyzed recent mortgage finance data for Claiborne County (FFIEC 2001, 2002, 2003, 2004, 2005) to evaluate the potential need for new housing in the vicinity. The Federal Financial Institutions Examination Council (FFIEC) annually collects data on each mortgage finance transaction in the country from institutions required to report, including banks, mortgage companies, credit unions, and other finance companies. The detailed transaction data and borrower characteristics are provided to the census tract level. Table 5-1 provides a summary of such transactions reported in Claiborne County over the recent 5-year period. The data indicate that the 225 financed home purchases over the five years ending in 2004 have been evenly distributed across the county's three census tracts: the northern portion of the county, the Port Gibson area, and the southern portion of the county. Section 5.5.2 indicates that plant workers moving to the region would most likely locate in the Vicksburg area where housing and services are most available. The home purchase data summarized in Table 5-1 suggest that Claiborne County conservatively averages just 45 home sales annually, distributed somewhat evenly across the county.

Table 5-1. Mortgage Transactions in Claiborne County, Mississippi, 2000 to 2004

	2000	2001	2002	2003	2004
Home Purchase Mortgages	71	54	31	40	29
Average Loan Amount ($K)	43.2	52.3	47.5	55.3	62.4
Median Loan Amount ($K)	32.0	35.5	47.0	48.5	53.0
Average Annual Borrower Income ($K)	36.8	43.5	40.3	41.1	47.4
Median Annual Borrower Income ($K)	36	36	36	32	47

Source: FFIEC Home Mortgage Disclosure Act data (FFIEC 2001, 2002, 2003, 2004, 2005). These data include only mortgage transactions financed through Federally regulated institutions. Cash purchases are not included.

Based on this analysis and information presented in Section 5.5.2, the staff finds that relocating workers would tend to seek housing where it is currently most available and where the choice of homes is greatest, such as Vicksburg, Natchez, or Clinton. Relocation in proportion to the current distribution of worker residences is unlikely, given current housing availability in Claiborne County. It is not possible to know what real estate or land development might occur in Claiborne County as a result of siting and operating the ESP facility. Therefore, the staff concludes that land-use impacts from development of new housing would occur, but such impacts would be widely disbursed and would not be concentrated in any one community. Such impacts might include land-cover alteration on private lands, new property access roads, or conversion from private agricultural to residential use.

Adding the Grand Gulf ESP facility to the Grand Gulf Nuclear Station (GGNS) site would introduce staggered refueling and maintenance outages. It is likely that outages would be scheduled for one facility at a time, increasing the frequency of the need for temporary outage workers and increasing the number by 100 to 200 workers (SERI 2005a). This increase in frequency would lead to increased impacts at local campgrounds and other local temporary housing facilities in the vicinity on a sustained basis. However, these impacts would not be expected to noticeably alter current land uses in the vicinity.

Another potential impact on land use includes the effects of salt drift on crops, timber, and other vegetation from operation of wet cooling towers (either natural or mechanical draft) that have been proposed for the Grand Gulf ESP facility. Forests both on the Grand Gulf site and offsite to the northwest of the ESP facility would be in the path of vapor plumes carried on southeasterly prevailing winds (SERI 2005a) and could thus be affected by salt drift. However, agricultural land occurs only offsite and largely to the southeast and east of the Grand Gulf ESP site, and thus would be less likely to be affected by salt drift, based on the direction of prevailing winds.

The staff assumed that new cooling towers would produce salt concentrations similar to cooling towers at existing nuclear power plants. New cooling towers would be located near the existing natural draft cooling tower at the Grand Gulf site and would be subject to the same meteorological conditions and, therefore, produce a similar plume footprint, potentially tripling the current salt deposition. A salt drift deposition study was conduced for GGNS Unit 1 from 1983 to 1988. The salt drift deposition rate was not significantly different between onsite and offsite locations. Consequently, a supplemental study was not undertaken to determine the biological effects of the salt at the Grand Gulf site (Entergy 1992). The impact of salt drift on crops, ornamental vegetation, and native plants was evaluated for existing nuclear power plants in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996) and was found to be of minor significance. This determination also included existing nuclear power plants with more than one cooling tower. Consequently, damage to timber or crops from the operation of cooling towers for the Grand Gulf ESP facility would be negligible.

Impacts on land use that would occur include minor land cover alterations because of the geographically disbursed construction of new housing for ESP facility workers. Therefore, the staff concludes that land-use impacts in the vicinity of the ESP facility due to operations would be SMALL, and additional mitigation would not be warranted.

5.1.2 Transmission Line Rights-of-Way and Offsite Areas

Section 4.1.2 indicates that although the current transmission system serving the GGNS site is likely to be inadequate under the bounding assumptions of the PPE, the full extent of changes to the transmission system cannot be known until an applicant for a CP or COL initiates the Federal Energy Regulatory Commission process for connecting new large generation to the grid. This process is discussed more specifically in Section 3.3. Whether that process results in findings that the existing rights-of-way can be upgraded, or that new rights-of-way must be acquired, maintenance of the transmission lines is expected to be accomplished using standard industry practices and following applicable laws and regulations. Impacts on land use would occur as a result of normal maintenance activities, such as right-of-way vegetation clearing, transmission line maintenance, and other normal access needs. Impacts on land use during the construction phase are discussed in Section 4.1.2, and the subsequent impacts of transmission line and right-of-way maintenance would be minimal. These may include access easements, building restrictions, temporary closures, and other activities as part of routine maintenance.

Based on information provided by SERI (2005a) and the U.S. Nuclear Regulatory Commission (NRC) staff's independent review, the staff concludes that land-use impacts in the transmission line rights-of-way and offsite areas from ESP facility operations would be SMALL, and additional mitigation would not be warranted.

5.2 Meteorological and Air Quality Impacts

Sections 2.3.1 and 2.3.2 describe the meteorological characteristics and air quality of the Grand Gulf ESP site. The primary impacts of operation of the Grand Gulf ESP facility on local meteorology and air quality would be from releases to the environment of heat and moisture from the primary cooling system (cooling towers), effluent from operation of auxiliary equipment (generators and boilers), and emissions from workers' vehicles. This section provides information on these factors and discusses the potential impacts of transmission line rights-of-way on air quality.

5.2.1 Cooling System

The proposed cooling system for the new nuclear unit or units at the Grand Gulf ESP site is wet cooling towers. Both natural draft and mechanical draft cooling towers are being considered. The most apparent impacts of wet cooling towers are the land use and aesthetic impacts associated with visible plumes. The air-quality impacts of wet cooling towers are associated with the drift from the cooling towers and possible interactions between the moist plumes and other pollutants. Wet cooling towers at existing nuclear power plants generally have drift eliminators to reduce drift.

Drift is composed of small water droplets that are carried out of the cooling tower. These droplets evaporate, leaving particles that contain residual salts and chemicals from the cooling water. Drift from mechanical draft cooling towers is deposited near the cooling tower, and drift from natural draft towers is deposited farther downwind. Based on a review of the measurements of deposition of drift from nuclear power plants, the GEIS (NRC 1996) states the "...measurements indicate that, beyond about 1.5 km (1 mi) from nuclear plant cooling towers, salt deposition is not significantly above natural background levels."

Based on the above considerations and the assumption that cooling towers associated with the new nuclear unit or units would be similar to cooling towers at existing nuclear plant sites, including the GGNS, the staff concludes that the impacts of the cooling towers on air quality would be SMALL and additional mitigation would not be warranted.

5.2.2 Routine Releases Other than Cooling System

Operation of auxiliary equipment, such as generators and boilers associated with a postulated facility at the Grand Gulf ESP site, would be intermittent. SERI provided bounding values for particulate sulfur and nitrogen oxides, carbon monoxide, and hydrocarbon emissions from auxiliary boilers, standby diesel generators, and standby power system gas turbines in the PPE. Auxiliary boilers are assumed to operate 30 days per year, and standby diesel generators and standby power system gas turbines are assumed to operate 4 hours per month. SERI (2005a) states that gaseous releases associated with the postulated units would comply with Federal, State, and local emission standards.

No major air pollution sources exist near the Grand Gulf ESP site. Diesel generators and boilers at the GGNS operate for limited periods. Generators and boilers associated with the new nuclear unit or units would also be operated for limited periods. Emissions from the generators and boilers would be minor compared to emissions from boilers and generators that run continuously. Interactions between pollutants emitted from these sources and the plumes from the new nuclear unit cooling towers would be intermittent and would not have a significant impact on air quality.

Because these systems are used on an infrequent basis and no significant industrial source exists within 16 km (10 mi) of the proposed site, the staff concludes the impacts of these releases would be SMALL.

5.2.3 Transmission Line Impacts

The impacts of existing transmission lines on air quality are reviewed in the GEIS (NRC 1996). Small amounts of ozone and smaller amounts of oxides of nitrogen are produced by transmission lines. The small amounts of these gases were found to be insignificant for

745-kV lines (the largest lines in operation) and for a prototype 1200-kV line. In addition, the staff determined that potential mitigation measures would be very costly and would not be warranted. The largest existing line in the transmission and distribution system serving the proposed Grand Gulf ESP site is a 500-kV line, well within the range of lines considered in NUREG-1437.

Based on the information provided by SERI, the staff's independent review, and the analyses discussed above, the staff concludes the potential transmission line impacts of operation of the Grand Gulf ESP facility would be SMALL, and additional mitigation would not be warranted.

5.3 Water-Related Impacts

Water-use and water-quality impacts involved in the operation of a nuclear power plant are similar to the impacts that would be associated with any large thermoelectric power generation facility. Accordingly, SERI would need to obtain similar water-related permits and certifications as any other large industrial facility. These would likely include

- Clean Water Act Section 401 certification. This certification would be issued by the Mississippi Department of Environmental Quality (MDEQ) and would ensure that the project does not conflict with State water quality management programs.

- Clean Water Act Sections 402(a) and 402(p) National Pollutant Discharge Elimination System (NPDES) discharge permit. These permits would be issued by MDEQ and would regulate point source and storm water discharges. The U.S. Environmental Protection Agency (EPA) has delegated the responsibility for administering the NPDES program in Mississippi to MDEQ.

- Clean Water Act Section 316(a). This section regulates heated and chlorinated cooling water discharges to protect the health of the aquatic habitat.

- Clean Water Act Section 316(b). This section regulates cooling water intake structures to minimize environmental impacts associated with location, design, construction, and capacity of those structures.

- Section 10 of the Rivers and Harbors Act of 1899. This section prohibits the obstruction or alteration of navigable waters of the United States without a permit. Appropriate U.S. Army Corps of Engineers (ACE) permits would need to be obtained for maintenance of the proposed intake and discharge structures on the shore of the Mississippi River.

- Section 1424(e) of the Safe Drinking Water Act of 1974. This section prohibits any commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) for any project which the EPA Administrator determines may contaminate an aquifer designated by the Administrator to be a sole-source aquifer. EPA has identified the Southern Hills Aquifer, which includes the Catahoula formation beneath the Grand Gulf ESP site, to be a sole-source aquifer (EPA 1998).

Managing water resources requires understanding and balancing the tradeoffs between various, often conflicting objectives. At the Grand Gulf ESP site, these include navigation, recreation, visual aesthetics, fishery, and a variety of beneficial consumptive domestic and industrial uses of water. The responsibility for regulating water use and water quality is delegated to ACE and MDEQ through Federal laws and laws of the state of Mississippi. This section discusses the estimated impacts on water use and water quality resulting from operation of a facility at the Grand Gulf ESP site bounded by the PPE.

5.3.1 Hydrological Alterations

The staff did not identify any significant changes to the local flow patterns or intensities that would occur at the site due to operation. The site drainage system would generally drain surface water runoff and storm flow in approximately the same levels to Stream A and Stream B. Any increase in runoff intensity resulting from the increase in the impervious surface area would be mitigated using standard engineering storm water management practices pursuant to the site's NPDES storm water management program. Given the small amount of water withdrawn for a new nuclear facility relative to the large flow of the Mississippi River, the intake and discharge would have minimal impact on the river's flow pattern adjacent to the shoreline.

Any dewatering systems active during operation would only impact the shallow aquifers. However, based on the character of the shallow groundwater system, the staff concluded that any impacts on the groundwater flow pattern would be localized and any change would unlikely extend beyond the site boundary.

Based on the above, the NRC staff concludes that the impact of hydrological alterations from operation would be SMALL, and additional mitigation would not be warranted.

5.3.2 Water-Use Impacts

Certain details concerning operation of a new nuclear facility at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis is not to the depth warranted for actual operation. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

Operation Impacts at the Proposed Site

A new nuclear facility would use surface water from the Mississippi River for cooling purposes and groundwater from the Catahoula formation for other facility water needs. By far, the largest single use of water for the proposed Grand Gulf ESP facility would be makeup for the normal heat sink. SERI stated that operation of the makeup water system for a new facility would have a negligible impact on the use and water supply of the Mississippi River (SERI 2005a). Normal makeup flow rate to a new nuclear facility would be approximately 3175 L/s (50,320 gpm), and the maximum expected makeup flow would be 5400 L/s (85,000 gpm). About 25 percent of this water would be returned to the Mississippi River as blowdown. The staff concludes that a new facility would withdraw only a small amount of water relative to the total river flow (about 0.2 percent) at even the lowest minimum river discharge conditions recorded for the area. Also, because of the proposed location and the small area of the river that would be affected by the proposed new facility, the staff concludes that the intake structure would not affect recreational or commercial fishing operations or otherwise restrict navigation on the Mississippi River. Because the withdrawal would be small relative to river flow (conservatively considering withdrawals for both the proposed ESP unit(s) and the existing GGNS Unit 1), the staff concludes that impacts would be small.

SERI stated that no water from Stream A or Stream B would be used by the proposed new nuclear facility (SERI 2005a). However, the alteration of the existing landscape would likely increase the impervious surfaces at the site, thereby increasing storm water flow. While this could possibly alter the timing and magnitude of runoff without significantly altering the overall water budget, the staff concludes that, by employing standard best management practices for storm water management, the impact of the ESP facility on water uses associated with Stream A and Stream B would be insignificant.

No new consumptive wells in the Holocene alluvial aquifer are proposed for operation of the new facility; therefore, the staff concludes no impacts would be anticipated on the alluvial aquifer.

SERI (2005a) stated that the use of the additional wells installed in the Catahoula formation for water needs other than for cooling makeup water would not significantly affect the groundwater water surface elevation in the vicinity. However, the staff concludes that the characterization of the Catahoula aquifer was inadequate to support such a conclusion, particularly given the significance of the aquifer to local domestic water supplies and its designation by EPA as a sole-source aquifer (EPA 1998). Because of the limited number of borings, hydraulic conductivity measurements, and long-term pump tests in this portion of the aquifer that are currently available, the staff was unable to assess reliably the impact of a significant increase in the groundwater withdrawal at the Grand Gulf ESP site. Given the information provided in the applicant's environmental report and the staff's independent review, impact on the Catahoula formation could be SMALL if the proposed withdrawal had little effect on the Catahoula formation or MODERATE if the proposed withdrawal were to adversely affect current water withdrawals elsewhere in the aquifer. An applicant for a CP or COL referencing an ESP for the

Grand Gulf ESP site would need to provide additional information on the ability of the Catahoula aquifer to sustain withdrawals in order for the staff to make a significance determination with respect to this resource. Use of wells that withdraw from the Catahoula formation would be in accordance with applicable standards published in the MDEQ groundwater use and protection regulations (MDEQ1994), and necessary permits would be obtained from the MDEQ. MDEQ regulations allow for permit denial or reduction of withdrawal rate if such a withdrawal is expected to interfere with existing permitted uses of if it conflicts with the public interest.

Based on its review, the staff concludes that the issue of water-use impacts resulting from operational activities on groundwater at the Grand Gulf ESP site is unresolved. Additional aquifer characterization would need to be provided by an applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site.

5.3.3 Water-Quality Impacts

Certain details concerning operation of a new nuclear facility at the Grand Gulf ESP site are not known at the ESP stage. Consequently, the staff's analysis is not to the depth warranted for actual operation. It is, however, sufficient for the purpose of comparing the proposed action to the alternatives.

In Section 5.3.2 of its environmental report (SERI 2005a), SERI described the impact of effluent discharges from both the existing GGNS Unit 1 and the proposed ESP facility. While the specific design of the outfall, including the diffuser, has not yet been specified, parameters from the PPE were used to bound the impact of the outfall on the river environment. Environmental parameters, such as river discharge and receiving water temperature, were also varied in this analysis, using the historical record.

5.3.3.1 Mississippi River

SERI's environmental report (2005a) assumed the discharge outfall would enter the Mississippi River several hundred feet downstream of the intake screens and on the east bank (the same side as the Grand Gulf ESP site) of the river. The proposed discharge would enter perpendicular to the river via a shoreline-located discharge canal that would be rectangular in cross-section. The canal at the terminus was assumed to be 10 m (33 ft) wide by 0.5 m (1.6 ft) deep. Regardless of river environment, local river depth at the shoreline- located discharge exit would be 0.5 m (1.6 ft) deep, and the bank would slope 19.3 degrees. Based upon PPE values for the Grand Gulf ESP facility and the *Updated Final Safety Analysis Report* (UFSAR) (MP&L 1994) for GGNS Unit 1, the bounding discharge flow rate was assumed to be 3.34 m^3/s (52,900 gpm) at a temperature of 37.7°C (100°F).

Operation Impacts at the Proposed Site

For purposes of determining bounding conditions, the variable flow conditions of the river were examined. Mississippi River flows examined by SERI (SERI 2005a) were assumed to be either 15,860 m^3/s (560,000 cfs) for average river flow or 3653 m^3/s (129,000 cfs) for low river flow. The river was assumed to be rectangular in cross-section, with a constant width of 884 m (2900 ft) and a depth of either 9.44 m (31.0 ft) for the average river flow or 2.44 m (8.00 ft) for low river flow. These combinations of discharges and cross-sectional areas results in a mean ambient river velocity of 1.9 m/s (6.2 ft/s) for average flow and 1.69 m/s (5.54 ft/s) for low flow. Ambient winter river water temperatures examined were 1°C (34°F) and 4°C (39°F) and ambient summer river water temperatures were 27.8°C (82.0°F) and 30.6°C (87.1°F).

SERI estimated the length and width of the discharge plume using the Cornell Mixing Zone Expert System (CORMIX) version 3.2 (Jirka et al. 1996). Simulation parameters and summary of results are shown in the environmental report (SERI 2005a). The plume width and length were defined in the analysis as the location of the 2.8°C (5°F) isotherm. CORMIX version 3.2 results indicate the maximum width and length of the plume to have occurred with the higher discharge and colder river case. Under these conditions, the worst case (i.e., largest) surface extent of the plume was reported to be 187 m (614 ft) long and 16.3 m (53.5 ft) wide.

The NRC staff performed an independent analysis of the outfall plume using CORMIX version 4.3 (Jirka et al. 2004). This is the most recent version of the CORMIX model available and includes several revisions to the buoyant plume algorithms that are germane to the SERI application. The staff's evaluation assumed that the discharge plume would enter perpendicular to the river, several hundred feet downstream of the intake screens. The canal terminus was assumed to be 10 m (33 ft) wide by 0.5 m (1.6 ft), and the local river depth at the outfall location was assumed to be 0.5 m (1.6 ft). Based on the UFSAR (MP&L 1994), the slope of the protected river bank was assumed to be 14 degrees (approximately 4 ft horizontal for every vertical foot). Based upon PPE bounding values (SERI 2005a) and the UFSAR (MP&L 1994), the outfall discharge was assumed to be 3.34 m^3/s (52,900 gpm) at a temperature of 37.7°C (100°F).

The staff evaluated two assumed river discharges during their analysis. These discharges were based on monthly average Mississippi River streamflow data collected between 1931 and 1998 near Vicksburg by the U.S. Geological Survey (USGS 2004). From this dataset, the mean flow was approximately 17,040 m^3/s (601,800 cfs) and the low flow was 3115 m^3/s (110,000 cfs). Water temperature data maxima and minima were examined between 1962 and 1979 to determine bounding values. Based upon the UFSAR (MP&L 1994), the average winter water temperature is 5°C (41°F) with a minimum of approximately 1°C (34°F). The average summer river temperature is 27.8°C (82.0°F), with a maximum of 30.6°C (87.1°F).

The cross-sectional areas of the river at both the mean and the low flow were determined using ACE (2001), SERI's environmental report (SERI 2005a), and the UFSAR (MP&L 1994). For the mean flow scenarios, the river width was 1000 m (3281 ft) and the average water depth was 13 m (43 ft), resulting in an ambient river water velocity of 1.31 m/s (4.30 ft/s). For the low-flow scenarios, the river width was 730 m (2400 ft) and the average water depth of 5.7 m (19 ft), resulting in an ambient river water velocity of 0.75 m/s (2.5 ft/s). Ambient water velocities match typical observed values at similar river discharges.

Plume dimensions computed using CORMIX version 4.3 are presented in Table 5-2 for the eight different scenarios. The plume is larger in winter because of the much larger difference between ambient and outfall temperatures. The winter low-flow scenario with the minimum ambient river temperature produced the largest plume, with a length of 387 m (1270 ft) and a width of 58 m (190 ft). The winter low-flow scenario results in a mixing zone of 2.2 ha (5.5 ac).

Table 5-2. Dimensions of 2.8°C (5.0°F) Isotherm Plume in the Mississippi River Based on the Staff's CORMIX Simulations

			Low River Flow 3115 m^3/s		Average River Flow 17,040 m^3/s	
Case Studied	**Ambient River Temperature(a)**	**Isotherm Above Ambient Considered(a)**	**Mixing Zone Length(b)**	**Mixing Zone Width(b)**	**Mixing Zone Length(b)**	**Mixing Zone Width(b)**
Summer high temperature	30.6 (87)	2.8 (5.0)	72 (236)	36 (118)	8 (26)	10 (33)
Summer average temperature	27.8 (82)	2.8 (5.0)	75 (246)	34 (112)	8 (26)	9 (30)
Winter mean temperature	5 (41)	2.8 (5.0)	352 (1150)	53 (174)	254 (833)	21 (69)
Winter low temperature	1 (34)	2.8 (5.0)	387 (1270)	58 (190)	265 (869)	26 (85)

(a) °C (°F).
(b) meters (feet).

In addition to these scenarios, several submerged single-port diffuser outfalls were tested to determine if the size of the plume could be increased beyond those shown in the table above. As expected, by using a port diffuser located beneath the water surface, the buoyant jet entrained ambient water as it rose to the surface. It was therefore concluded that the shoreline diffuser discussed above is indeed the bounding case.

The maximum predicted size of the 2.8°C (5°F) above-ambient isotherm predicted by CORMIX version 4.3 is an approximately 400-m by 60-m (1300-ft by 200-ft) wedge-shaped region downstream of the outfall diffuser. By comparison, the Mississippi River is approximately 1000 m (3281 ft) wide at this location. An approximate sketch of this plume in relation to the site is shown in Figure 5-1. The NRC staff concludes, therefore, that the impact of the thermal plume on the Mississippi River would be small and localized. The thermal discharge to the Mississippi River would be regulated by the MDEQ.

The staff extended its thermal impact assessment using the CORMIX model to consider the potential impacts of chemical pollutants in the discharge to the Mississippi River. The results presented in Table 5-2 can be used to derive mixing zone dilution factors for the cases considered in the thermal analysis. The dilution factor is the fractional concentration of a unit concentration in the discharge at the edge of the mixing zone. For instance, if the dilution factor were 10 percent and the discharge concentration were 20 ppm, then the concentration at the edge of the mixing zone would be 2 ppm. Table 5-3 presents dilution factors and the mixing zone (plume) dimensions for the four scenarios considered in the staff's thermal analysis.

For an 8-percent dilution factor, based on the low-flow condition, the mixing zone for the combined discharge from GGNS Unit 1 and the proposed ESP facility would be approximately 400 m long by 60 m wide (1300 ft by 200 ft). Again, this 60-m (200-ft) width is in comparison to the 1000-m (3281-ft) width of the Mississippi River at this location. The chemical discharge to the Mississippi River would be regulated by the MDEQ. The blowdown flow rate is expected to be more than 100 times greater than these other sources of non-radioactive liquid discharges. Any effluents from these other sources would be diluted by the blowdown effluent before entering the Mississippi River. However, SERI did not provide information in the PPE or environmental report defining the bounds of concentrations of chemical effluents to be discharged to the Mississippi River for sources other than the cooling water blowdown. Consequently, this issue is not considered to be resolved. Accordingly, impacts on Mississippi River water quality from chemical effluents (other than in blowdown) cannot now be determined. An applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide information on the concentrations of chemical effluents to the NRC.

5.3.3.2 Streams A and B

SERI stated that discharges to Streams A and B from the Grand Gulf ESP facility would include sanitary waste water, storm water, and sump drains. SERI did not provide information in the environmental report defining the bounds of concentrations of chemical effluents to be discharged to Streams A and B (SERI 2005a). Consequently, this issue is not considered to be resolved. An applicant for a CP or COL referencing an ESP for the Grand Gulf ESP site would need to provide information on the concentrations of chemicals in effluents to the NRC. The allowable concentrations and volumes of such effluents to Streams A and B would be regulated by the MDEQ.

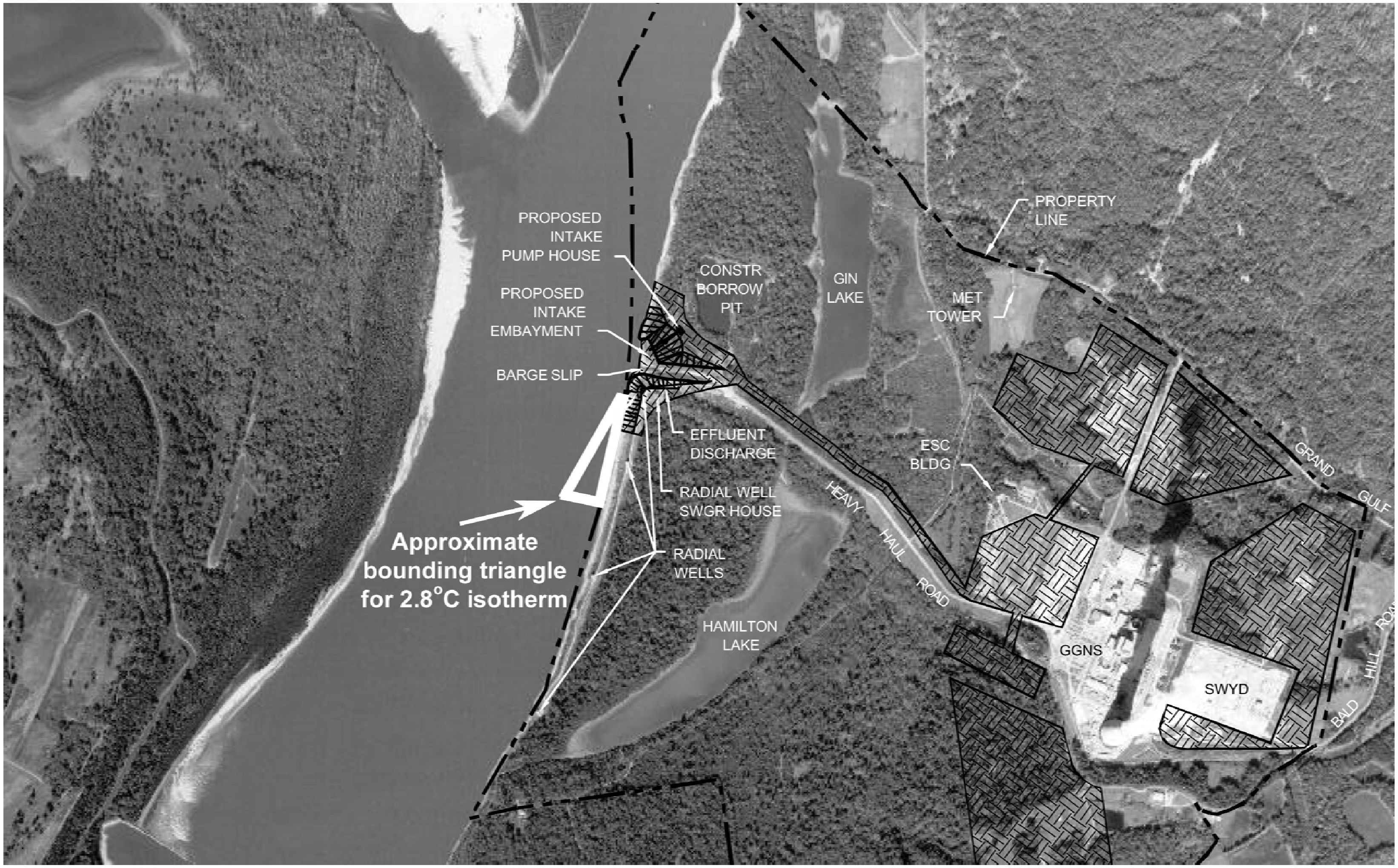

Figure 5-1. Bounding Triangle for the Location of the 2.8°C Above-Ambient Isotherm Based upon the Winter Extreme Temperature Difference, Low-Discharge Scenario

Table 5-3. Dilution Factors for Chemical Discharge to the Mississippi River Based on the Staff's CORMIX Simulations

Case Studied	Dilution Factor
Summer high temperature	28%
Summer average temperature	39%
Winter mean temperature	9%
Winter low temperature	8%

5.3.3.3 Groundwater

If very deep groundwater drawdowns were to occur resulting from high groundwater withdrawal rates during operation of the Grand Gulf ESP facility, it is conceivable that lower quality groundwater from deeper aquifers would be induced to flow upward into the Catahoula formation and possibly degrade the quality of water in the Catahoula formation. Given the information provided in the applicant's environmental report and the staff's independent review, impacts on the Catahoula formation could be SMALL if the proposed withdrawal had little effect on the Catahoula formation or LARGE if the proposed withdrawal were to induce degradation of the water quality of the sole source aquifer. Further aquifer characterization is needed to determine the impacts of additional groundwater withdrawals from the Catahoula formation. Therefore, the issue of impacts to groundwater quality resulting from operational activities at the Grand Gulf ESP facility is not resolved. An applicant for a CP or COL that references the ESP for the Grand Gulf ESP site would need to provide such additional information for the staff to make a significance determination with respect to impacts on groundwater quality.

5.3.3.4 Summary

SERI did not provide PPE values for non-radioactive liquid discharges other than the blowdown. Although the impact to surface water quality would be SMALL if discharges were within the limits of the existing GGNS NPDES permit, the staff cannot rely on assumed compliance with a permit in order to reach a conclusion regarding the magnitude of impact. Additional information regarding the constituents and associated concentrations for all liquid effluent sources is needed in order to determine the impacts of operation on surface water quality to the Mississippi River and Streams A and B. Therefore, the issue of impacts to surface water quality resulting from operational activities at the Grand Gulf ESP facility is not resolved. An applicant for a CP or COL that references the ESP for the Grand Gulf ESP site would need to provide such additional information for the staff to make a significance determination with respect to impacts on surface water quality.

Water quality impacts to the groundwater resources would be SMALL if the proposed groundwater withdrawal had little impact on the Catahoula formation or LARGE if the proposed groundwater withdrawal were to induce degradation of the water quality of the sole source Catahoula aquifer. The staff concludes that further aquifer characterization is needed to determine the impacts of additional groundwater withdrawals from the Catahoula formation. Therefore, the issue of impacts to groundwater quality resulting from operational activities at the Grand Gulf ESP facility is unresolved. An applicant for a CP or COL that references the ESP for the Grand Gulf ESP site would need to provide such additional information for the staff to make a significance determination with respect to impacts on groundwater quality.

5.4 Ecological Impacts

This section describes the potential impacts from operation of the Grand Gulf ESP facility, including transmission lines and associated right-of-way maintenance, to terrestrial ecosystems, aquatic ecosystems, and threatened and endangered species.

5.4.1 Terrestrial Ecosystems

The proposed cooling system for the Grand Gulf ESP facility is closed-cycle that would employ either natural or mechanical draft cooling towers. The rejected heat would be manifest in the form of water vapor plumes. Impacts associated with vapor plumes include those resulting from salt drift, fogging, and icing. Vapor plumes may affect crops, ornamental vegetation, and native plants, and water losses could affect shoreline habitat. In addition, bird collisions and noise-related impacts are possible with wet cooling towers. Each of these topics is discussed in the following paragraphs.

Electric transmission systems have the potential to affect terrestrial ecological resources through right-of-way maintenance, bird collisions with power lines, and electromagnetic fields (EMFs). The transmission and distribution system existing at the time of startup and operation of the proposed Grand Gulf ESP facility would be relied upon to distribute the power generated. A study conducted by SERI concluded that the existing system is adequate for an additional 1311 MW(e) generating capacity, assuming that modifications and upgrades are made to equipment in the switchyard of GGNS Unit 1. However, the maximum generating capacity is approximately 3000 MW(e) (SERI 2005a). If 3000-MW(e) generating capacity were installed, the existing transmission lines would have to be upgraded or additional transmission lines would be required.

Should the Grand Gulf ESP facility be constructed, the actual need for and nature of any transmission system improvements would be determined definitively prior to or during the CP or COL phase by the transmission and distribution system owner and operator (currently Entergy

| Mississippi, Inc.) under Federal Energy Regulatory Commission Order No. 2003 | (18 CFR Part 35). The magnitude of the environmental impacts associated with any transmission system improvements would also be established by the transmission and distribution system owner and operator at that time.

5.4.1.1 Impacts on Crops, Ornamental Vegetation, and Native Plants

Impacts on crops, ornamental vegetation, and native plants may result from cooling tower salt drift, icing, fogging, or increased humidity. No agricultural land exists on the Grand Gulf site. Offsite and in the immediate vicinity of the location of the Grand Gulf ESP facility, there is agricultural land only to the southeast and east, and winds originate most frequently in the | southeast (SERI 2005a). Based solely on the direction of prevailing winds, it appears unlikely that cooling tower impacts on crops and ornamental vegetation would result. However, forests and forested wetlands both onsite and offsite to the northwest of the Grand Gulf ESP facility could be in the path of vapor plumes carried on southeasterly prevailing winds and could thus be affected.

It is assumed that new cooling towers would produce salt concentrations similar to cooling towers at existing nuclear power plants. New cooling towers would be located near the existing natural draft cooling tower at the Grand Gulf site and be subject to the same meteorological conditions and hence produce a similar plume footprint, potentially tripling the current salt deposition. A salt drift deposition study was conducted for GGNS Unit 1 from 1983 to 1988. The salt drift deposition rate was not significantly different between onsite and offsite locations. Consequently, a supplemental study was not undertaken to determine the biological effects of salt drift at the Grand Gulf site (Entergy 1992). The impact of salt drift on crops, ornamental vegetation, and native plants was evaluated for existing nuclear power plants in the GEIS | (NRC 1996) and was found to be of minor significance. This determination also included existing nuclear power plants with more than one cooling tower. Information from the GEIS for license renewal is useful for this analysis. Therefore, the potential impact on crops, ornamental vegetation, and native plants from the operation of cooling towers for the Grand Gulf ESP | facility would be minimal and mitigation would not be warranted.

5.4.1.2 Bird Collisions with Cooling Towers

Although the Grand Gulf ESP site is located adjacent to the Mississippi River and thus along the Mississippi flyway (Bird Nature 2004), no bird collisions have been reported for the existing | 159-m (522-ft) GGNS Unit 1 natural draft cooling tower (SERI 2005a). However, there is no plan in place to monitor and report avian fatalities. The conclusion presented in the GEIS (NRC 1996) is that bird collisions with natural draft cooling towers are of small significance at all operating nuclear power plants, including those with multiple cooling towers. Mechanical draft cooling towers are known to cause only negligible avian mortality and were thus not addressed in the GEIS (NRC 1996). Consequently, the incremental number of bird collisions, if any, associated with the operation of one or more wet cooling towers for the proposed Grand Gulf ESP facility, regardless of the type of cooling tower (natural or mechanical draft) employed, would be minimal and mitigation would not be warranted.

5.4.1.3 Noise

For both natural and mechanical draft cooling towers, the noise levels from cooling tower operation is anticipated to be 55 decibels (dBA) at 300 m (1000 ft) (SERI 2005a). This noise level is well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating natural or mechanical draft cooling towers would not be likely to disturb wildlife beyond the Grand Gulf site perimeter fence, which is over 300 m (1000 ft) from the source. Consequently, the potential impact on wildlife posed by the incremental noise resulting from the operation of one or more wet cooling towers for the Grand Gulf ESP facility would be minimal and additional mitigation would not be warranted.

5.4.1.4 Shoreline Habitat

Because of the small quantity of water withdrawn and discharged during operation relative to the flow in the Mississippi River, adverse impacts on the river shoreline are unlikely. SERI has estimated the water use for the Grand Gulf ESP facility and the areal extent of the thermal plume (SERI 2005a). The staff's independent assessment is presented in Section 5.3.2. The amount of water to be withdrawn from the Mississippi River represents about 0.2 percent of the total lowest minimum flow. The discharge plume, based on the 2.8°C (5°F) above-background isotherm, would range from 8 to 400 m (26 to 1300 ft) in length and 9 to 60 m (30 to 200 ft) in width, depending on season and flow (Section 5.3.2). No additional shoreline habitat would be exposed from the water removal, and evaporative loss for the proposed facility would be undetectable and not likely to affect shoreline plants or wildlife. Consequently, the potential effects on terrestrial ecology from the drawdown of the Mississippi River resulting from operation of one or more wet cooling towers for the Grand Gulf ESP facility would be negligible and mitigation would not be warranted.

5.4.1.5 Transmission Line Right-of-Way Management (Cutting and Herbicide Application)

It is currently anticipated that if the maximum generating capacity for the Grand Gulf ESP facility (approximately 3000 MW(e)) (SERI 2005a) were installed, the existing transmission lines would have to be upgraded or additional transmission lines would be required. It is assumed that any transmission line improvements, such as the addition of new lines and pole support structures, for example, would be sited within the existing transmission line rights-of-way to the greatest extent possible and that no new rights-of-way would be required (Section 4.4.1.2).

However, it is possible that the width of the existing rights-of-way would need to be increased (Section 4.4.1.2). Existing roads providing access to the current transmission line rights-of-way likely would be sufficient for use in any expanded right-of-way and no new roads would be required.

The staff assumes that the same vegetation management practices currently employed by Entergy Mississippi, Inc. for the existing GGNS Unit 1 facility transmission line rights-of-way (such as, bushhogging on an as-needed basis as discussed in Section 2.7.1.1) would be applied to any expanded rights-of-way associated with the Grand Gulf ESP facility. Thus, for the Grand Gulf ESP facility, vegetation management would simply occur along the same rights-of-way, but potentially over twice the area. Transmission line right-of-way maintenance was evaluated in the GEIS (NRC 1996), and the impact was found to be of small significance at operating nuclear power plants with associated transmission line rights-of-way of variable widths. Consequently, the incremental effects of transmission line right-of-way maintenance posed by increasing the width of the existing rights-of-way for the Grand Gulf ESP facility would be minimal. Entergy Mississippi, Inc. would follow best management practices and coordinate with Federal and State agencies; thus, no other mitigation would be warranted.

5.4.1.6 Bird Collisions with Transmission Lines

Transmission line and right-of-way maintenance personnel have not reported dead birds from collisions with the GGNS Unit 1 plant transmission lines. However, there is no plan in place to monitor and report avian fatalities under transmission lines. The conclusion presented in the GEIS (NRC 1996) is that bird collisions with transmission lines are of small significance at operating nuclear power plants, including transmission line rights-of-way with variable numbers of power lines.

Thus, although additional transmission lines could be required for the Grand Gulf ESP facility (see Section 4.4.1.2), these would likely present few new opportunities for bird collisions. The additional number of bird collisions, if any, would not be expected to cause a measurable reduction in local bird populations. Consequently, the incremental number of bird collisions posed by possible addition of new transmission lines for the Grand Gulf ESP facility would be negligible and mitigation would not be warranted.

5.4.1.7 Impact of Electromagnetic Fields on Flora and Fauna (Plants, Agricultural Crops, Honeybees, Wildlife, Livestock)

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). As discussed in the GEIS (NRC 1996), a careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures. Thus, the conclusion presented in the GEIS (NRC 1996) was that the impacts of EMFs on terrestrial flora and fauna were of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines. Since 1997, over a dozen studies have been published that looked at cancer in animals that were exposed to EMF for all or most of their lives (Moulder 2005). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2005). Therefore, the staff concludes that the incremental EMF impact posed by possible addition of new power lines for a new nuclear unit or units at the Grand Gulf ESP site would be minimal and mitigation would not be warranted.

5.4.1.8 Floodplains and Wetlands on Transmission Line Rights-of-Way

As noted earlier, the existing transmission lines would have to be upgraded or additional transmission lines would be required to support the full PPE. These upgrades likely would be sited within the existing rights-of-way to the greatest extent possible. However, these upgrades could potentially increase the width of the existing rights-of-way. It is assumed existing roads providing access to the current transmission line rights-of-way would be sufficient for use in any expanded right-of-way and that no new roads would be required.

The effects of transmission line right-of-way maintenance on floodplains and wetlands was evaluated previously in the GEIS (NRC 1996). The impacts were found to be of small significance at operating nuclear power plants, and these included transmission line rights-of-way of variable widths. The incremental effects of transmission line right-of-way maintenance on floodplains and wetlands posed by increasing the width of the existing rights-of-way for the Grand Gulf ESP facility would be negligible and mitigation beyond use of best management practices would not be warranted.

5.4.1.9 State-Listed Species

<u>Animal Species</u>

The endangered wood stork *(Mycteria americana)* was observed in the summertime on Gin and/or Hamilton lakes 18 years prior to construction of GGNS Unit 1 (AEC 1973). The wood stork should be considered a possible non-breeding transient to the Grand Gulf site and vicinity (SERI 2005a; MNHP 2004a, 2004b). Consequently, the potential impacts from collisions of the wood stork with cooling towers and/or any additional transmission lines associated with the Grand Gulf ESP facility are considered minimal.

<u>Plant Species</u>

The critically imperiled hairy waterclover (*Marsilea vestita*) and jug orchid (*Platythelys querceticola*), and the imperiled glade fern (*Diplazium pycnocarpon*) and American bittersweet (*Celastrus scandens*), are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the

Grand Gulf site (MNHP 2004b). The critically imperiled/imperiled Allegheny monkeyflower (*Mimulus ringens*) is known to occur about 17.6 km (11 mi) from the Grand Gulf site (SERI 2005a). Although the known locations of these five species occur at some distance from the Grand Gulf site, they could yet occur onsite. However, potential impacts on these five species from the effects of cooling tower operation (salt drift), transmission line operation, and right-of-way maintenance, as described above, are considered negligible.

5.4.1.10 Summary of Terrestrial Ecosystem Impacts

The potential impacts of operating wet cooling towers for the Grand Gulf ESP facility on crops, ornamental vegetation, native plants, birds, shoreline habitat, and any related impacts on State-listed species are considered negligible. The potential impacts of transmission line right-of-way maintenance (cutting and herbicide application) and similar impacts on floodplains and wetlands, birds, and biota due to EMFs and any related impacts on State-listed species are considered negligible.

The staff reviewed the potential terrestrial ecological impacts of a new generation facility at the Grand Gulf ESP site including the associated heat-dissipation system, transmission lines, and associated right-of-way maintenance. The staff concludes the impacts from operation of the Grand Gulf ESP facility would be SMALL, and additional mitigation beyond that mentioned in the text would not be warranted.

5.4.2 Aquatic Ecosystems

The potential impacts on the aquatic ecosystem from operation of a Grand Gulf ESP facility, including water intake, discharge of heated effluents, physical changes to aquatic systems from storm water collection, and transmission line right-of-way maintenance activities were evaluated.

5.4.2.1 Intake System

For aquatic resources, the primary concerns of water intake are the location of the cooling water intake structure and the potential for organisms to be impinged on the intake screens or entrained into the cooling-water system. Impingement occurs when organisms are trapped against intake screens by the force of the water passing through the cooling-water intake structure (66 FR 65256). Impingement can result in starvation and exhaustion, asphyxiation (water velocity forces may prevent proper gill movement or organisms may be removed from the water for prolonged periods of time), and descaling (66 FR 65256). Entrainment occurs when organisms are drawn through the cooling water intake structure into the cooling system. Organisms that become entrained are relatively small benthic, planktonic, and nektonic (organisms in the water column) forms, including early life stages of fish and shellfish, and which often serve as prey for larger organisms (66 FR 65256). As entrained organisms pass through a plant's cooling system, they are subject to mechanical, thermal, and toxic stress.

EPA has promulgated regulations that implement Section 316(b) of the Clean Water Act for new and existing electric power producing facilities (66 FR 65256; 69 FR 41576). The Phase II regulations apply to facilities that employ a cooling water intake structure and withdraw 50 million gallons per day or more of water from waters of the United States for cooling purposes. New nuclear unit or units at the Grand Gulf ESP site would be subject to these regulations. The regulations state that if the facility employs a closed-cycle cooling system, then the facility is deemed to have met the performance standards to reduce impingement mortality and entrainment. SERI has not yet finalized a detailed design of the cooling water system; however, the PPE identifies cooling system designs that employ the use of mechanical draft or natural draft cooling systems, both of which are considered a closed-cycle cooling system. Therefore, the staff believes that the ESP facilities would meet the performance standards specified in the EPA regulations implementing Section 316(b).

The Grand Gulf ESP facility would, as the existing GGNS Unit 1 does, use cooling towers. Losses of fish from impingement and entrainment are significantly less with systems that have cooling towers because relatively small volumes of makeup water are needed for the evaporative loss of water in comparison to systems with once-through cooling. GGNS Unit 1 uses radial wells located along the shoreline of the Mississippi River to collect makeup water through the influx of river and groundwater into the well system. The ESP facility would require more water than can be generated through the radial well network. An intake structure designed to collect water from the river itself is proposed to supply the makeup water for the proposed plant (SERI 2005a).

The proposed intake structure for the Grand Gulf ESP facility and the designs of the other portions of the cooling water system have not been finalized. The flow for makeup water from the Mississippi River is estimated to average 3175 L/s (50,320 gpm), with a maximum peak flow of 5400 L/s (85,000 gpm). The maximum peak flow would equal about 0.2 percent of the river flow at the Grand Gulf site under extreme low-flow conditions in the river—3653 m^3/s (129,000 cfs). The intake structure for the proposed Grand Gulf ESP facility would be of a different design than the existing radial well system currently used at the GGNS. The intake structure would be located along the upstream shoreline of the existing barge slip. The intake would consist of screened suction pipes supplying the makeup water pumps. The intake screens would be sized so that the average intake velocity through the screen would be less than or equal to 0.12 m/s (0.5 ft/s). The depth of the intake screens would be such that the removal of water would minimize the uptake of aquatic biota and river debris. The plans for the intake screen are based on a design that is currently being employed at the River Bend Station intake (SERI 2005a). Located on the Mississippi River at River Mile (RM) 262, the River Bend Station is a 2894 MW(t) nuclear power plant that uses closed-cycle cooling dissipating heat using mechanical draft cooling towers.

Operation Impacts at the Proposed Site

In correspondence with resource agencies associated with the Grand Gulf ESP facility, eight aquatic species that could be affected by operation of a new ESP facility (SERI 2005a) were identified as being of special interest. Four of these species are Federal or State-listed threatened or endangered species, and are discussed in Section 5.4.3: gulf sturgeon (*Acipenser oxyrinchus desotoi*), pallid sturgeon (*Scaphirhynchus albus*), bayou darter (*Etheostoma rubrum*) and crystal darter (*Crystallaria asprella*). Of the remaining fish species, chestnut lamprey (*Ichthyomyzon castaneus*), paddlefish (*Polyodon spathula*), and blue sucker (*Cycleptus elongatus*) were found in the Mississippi River and lakes on the Grand Gulf site in GGNS pre-construction surveys (MP&L 1973). The black buffalo (*Ictiobus niger*) has been reported from the Mississippi River in the vicinity of the Grand Gulf site (Ross 2001). The black buffalo is a species of "special concern" to the state of Mississippi (MNHP 2004a, 2004b). No biologically important areas (e.g., critical habitats) were identified by the resource agencies as being in the immediate vicinity of the Grand Gulf ESP site (SERI 2005a).

As adults, the fish of special interest described above would be able to avoid the proposed intake structure and not be impinged. Also, the design for the proposed intake structure would create a low-intake velocity that would not be likely to affect fish. Larval stages of fish and eggs of fish that are released into the water column travel at the speed of the current of the river. These organisms are susceptible to entrainment if they are trapped in the flow of an intake structure. A study conducted as part of the GGNS pre-construction surveys in 1972 to 1973 found that the numbers of fish larvae in the Mississippi River at Grand Gulf were low (MP&L 1973). No fish of special interest were collected. The amount of water that would be removed by the intake structure is about 0.2 percent of the overall flow in the river under extreme low-flow conditions.

Impingement and entrainment can be evaluated by comparing the proposed intake structure for a new ESP facility to the performance of the similarly designed structure at the once-through River Bend Nuclear Station. The intake structure at the River Bend Nuclear Station has an intake water velocity of 0.12 m/s (0.5 ft/s) or lower through the screens. The structure is located within an embayment so as not to block the passage of fish, similar to that proposed for the Grand Gulf ESP facility. The final environmental impact statement for the River Bend Nuclear Station (NRC 1985) concluded that impingement of organisms on the intake screens was not likely to be a problem because of low-intake velocities. Also, entrained plankton and other non-swimming species would be limited because the highest density of organisms was located on the far side of the river, away from the intake structure (NRC 1985). The staff is not aware of any recent studies of impingement or entrainment conducted at the River Bend Nuclear Station that indicate the impact on aquatic organisms has changed. Thus, the use of a similar intake structure at the Grand Gulf ESP facility would likely also pose a minimal impact from impingement and entrainment of aquatic organisms in the Mississippi River (SERI 2005a).

5.4.2.2 Aquatic Thermal Impacts

The effluent discharge from the Grand Gulf ESP facility would be directly into the Mississippi River, and would be located downstream of the intake embayment to avoid recirculation of effluents into the river water intake. While the design of the structure has not been finalized, it was assumed that the shoreline discharge would be located several hundred feet downstream of the intake screens. The proposed shoreline discharge would be a concrete structure 10 m (33 ft) wide by 0.5 m (1.6 ft) deep. The location is thought to be outside the influence of the intake structure and any currents created by the intake embayment and barge slip (SERI 2005a).

SERI and the staff have used the CORMIX model (Section 5.3.2) to estimate the size and temperature of the thermal plume from the existing Unit 1 and one or more new ESP nuclear units. The staff estimated plumes varying from 8 to 387 m (26 to 1270 ft) in length and 9 to 58 m (30 to 190 ft) in width (Figure 5-1). The size of the plume varied with the summer and winter conditions. The model defines the plume as a 2.8°C (5°F) degree difference in temperature from the ambient water temperature, thus the smaller size of the plume occurred during the summer.

Impacts on the aquatic organisms in the Mississippi River would be minimized by the proposed design of a closed loop cooling system with cooling towers for the Grand Gulf ESP facility. With this design, the majority of the waste heat would be discharged to the atmosphere and not the Mississippi River (SERI 2005a).

The size of the thermal plume from the proposed effluent discharge (defined as 2.8°C (5°F) or higher than the ambient temperature of the river) was determined to be small in comparison to the width of the Mississippi River at the Grand Gulf ESP site. Fish and other organisms in the river would move through the plume unencumbered by any structures or physical features that would retain them in the plume. Furthermore, fish will avoid elevated temperatures that are potentially harmful, if possible. The increase in temperature expected at the discharge could be disorienting to organisms moving through the plume, but the temperature is unlikely to be lethal (NRC 1981a; Fry 1971; Dean 1973; Beitinger et al. 2000).

Cold shock occurs when aquatic organisms that have been acclimated to warm water, such as fish in a power plant’s discharge canal, are exposed to a sudden temperature decrease. This sometimes occurs when single-unit power plants shut down suddenly in winter. Cold shock mortalities at U.S. nuclear power plants are “relatively rare” and typically involve small numbers of fish (NRC 1996). It is less likely to occur at a multiple-unit plant, because the temperature decrease from shutting down one unit is moderated by the heated discharge from the unit or units that continue to operate. At the Grand Gulf ESP site, the volume of the discharge in comparison to the flow of the river is very small. Furthermore, there is no confined area like a discharge canal that will attract the fish to the thermal plume and concentrate the organisms (SERI 2005a).

The thermal plume could affect the movement and distribution of the aquatic biota. The warmer water could attract some organisms during the colder months. Fish could avoid the plume if the temperature were too high. The location and design of the discharge would not impede fish passage. During normal and minimal flows of the river, the thermal discharge would be along the river bank. During the flood season, the discharge structure would be below the river level. The amount of water and swift current would quickly mix the effluent with the river water, thus minimizing any potential impact (SERI 2005a).

The location of the discharge along the bank of the Mississippi River, the buoyant nature of the plume, the large flow of the river, and the stabilization of the river shoreline by concrete mats and riprap would minimize other potential impacts on aquatic organisms from the thermal discharge of the proposed ESP facility. Aquatic insects and benthic macrofauna are not in great abundance along the shore of the Mississippi River, based on MP&L pre-construction surveys in 1972 to 1973, and the conditions are not thought to have changed over time. Nuisance organisms are not likely to be encouraged since the discharge is into the river flow and the substrate is not suitable for colonization by most of these organisms. The plume in the river would not be in a confined area for aquatic organisms and the flow of the river would not be encumbered by the proposed design such that predation, parasitism and disease, changes in dissolved gases, or accumulation of contaminants would become an issue (MP&L 1973; NRC 1981a; SERI 2005a).

5.4.2.3 Shoreline Erosion and Other Physical Impacts

As mentioned above, the shoreline of the Mississippi River at the GGNS has been stabilized by concrete mats and riprap. SERI has stated that any disruption of the stabilized banks would be addressed during operation of the Grand Gulf ESP facility. Periodic dredging of the intake embayment to remove sediment deposits and littoral debris carried into the embayment would be necessary. Dredging may lead to temporary increase in turbidity in river. These activities would require a permit from the ACE and could be timed and conducted to have a minimal impact on the existing aquatic resources in the vicinity (MP&L 1973; NRC 1981a; SERI 2005a).

5.4.2.4 Transmission Line Right-of-Way Maintenance Activities

Maintenance activities along the Baxter-Wilson and Franklin transmission line rights-of-way could lead to temporary impacts in the waterways being crossed. Plans for maintenance procedures of the widened rights-of-way have not been developed. The impacts on aquatic resources would vary depending on whether physical or chemical means for controlling vegetation in the rights-of-way are used. The maintenance procedures currently being used (primarily bushhogging performed on an as-needed basis) would likely continue (41 FR 24062). If widening the existing rights-of-way is needed, NRC expects that an applicant for a CP or COL referencing the Grand Gulf ESP would work with the appropriate Federal and State agencies and the transmission line owner, Entergy Mississippi, Inc., to develop and implement the plans for rights-of-way maintenance that would have minimal impacts on the aquatic ecosystems.

5.4.2.5 State-Listed Species

Animal Species

The endangered crystal darter (*Crystallaria asprella*) is found in Bayou Pierre and its tributaries, which flow as close as 3 km (1.9 mi) east of the Grand Gulf site (Ross 2001; MNHP 2004b; Katula 2004). Operation of the Grand Gulf ESP facility would not affect the regions where the crystal darter is found. The Franklin transmission line right-of-way crosses Bayou Pierre approximately 5.5 km (3.4 mi) to the south of the Grand Gulf site. NRC expects that SERI would work with the appropriate State agencies and the transmission line owner, Entergy Mississippi, Inc., to develop and implement plans for maintenance of the transmission line rights-of-way that would have minimal impacts on Bayou Pierre and the crystal darter.

Plant Species

No State-listed aquatic plant species are known to occur within 16 km (10 mi) of the Grand Gulf site (MNHP 2004a, 2004b).

5.4.2.6 Summary of Aquatic Ecosystem Impacts

The final design of the proposed intake and discharge systems for the Grand Gulf ESP facility would consider potential impacts on aquatic organisms under EPA regulations implementing Section 316(b) of the Clean Water Act. The use of cooling towers is a mitigative measure for reducing impacts from impingement and entrainment. The characteristics of the thermal discharge into the river would be reduced through the use of a cooling tower system. The NRC staff therefore concludes that the impact from operations would be SMALL, and additional mitigation would not be warranted. The NRC staff will verify that any necessary aquatic ecology monitoring (see Section 2.7.2.3) would be performed.

5.4.3 Threatened and Endangered Species

The potential impacts of operation of the ESP facility, including transmission lines and associated right-of-way maintenance, on terrestrial and aquatic Federally listed threatened and endangered species were evaluated. These species were identified through correspondence with the U.S. Fish and Wildlife Service (FWS) (FWS 2004a, 2004b), review of FWS county listings of such species for the state of Mississippi (FWS 2000), and correspondence with the National Oceanic and Atmospheric Administration (NOAA) Fisheries (NMFS 2004).

5.4.3.1 Federally Listed Animal Species

Florida Panther - Endangered

Currently no viable populations of the Florida panther (*Puma concolor coryi*) occur outside of Florida (SERI 2005a). Therefore, potential impacts on Florida panthers from facility and transmission line operation and right-of-way maintenance, as discussed in Section 5.4.1, would be minimal.

Bald Eagle - Threatened

Bald eagle (*Haliaeetus leucocephalus*) occurrences have not been reported within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b) or within several miles of transmission line rights-of-way (Section 4.4.3.1). Therefore, potential impacts on bald eagles from facility and transmission line operation and right-of-way maintenance, as discussed in Section 5.4.1, would be minimal.

Interior Least Tern - Endangered

The nearest areas occupied by least terns (*Sterna antillarum*) upstream and downstream from the Grand Gulf site (RM 405) (SERI 2005a) were at Yucatan Dikes (RM 409.8), Togo Island Dikes (RM 413.6), and Below Bondurant Towhead Dikes (RM 393.0) (ACE 2004). The areas occupied by least terns that are closest to the transmission line rights-of-way are about 3.2 km (2 mi) distant (Section 4.4.3.1). Therefore, potential impacts on interior least terns from facility and transmission line operation and right-of-way maintenance, as discussed in Section 5.4.1, would be minimal.

American Alligator - Threatened

The only Federally listed animal species known to inhabit the Grand Gulf site is the threatened American alligator (*Alligator mississippiensis*). However, the alligator is listed only because of its similarity of appearance to the American crocodile (*Crocodylus acutus*). American alligator populations are considered disjunct, limited to available habitat but stable (52 FR 21059). Although the alligator is present in wetland habitats onsite, potential impacts on the species from the effects of facility and transmission line operation and right-of-way maintenance, as discussed in Section 5.4.1, would be minimal.

Red-Cockaded Woodpecker - Endangered

The red-cockaded woodpecker (*Picoides borealis*) is not known from Claiborne County (Costa and Walker 1995) and would thus not be affected by facility operation. The species may occur in the vicinity of the Franklin transmission lines, but would not be expected to be adversely affected by operation of the lines and may be positively affected by right-of-way maintenance. Transmission line right-of-way maintenance practices that favor development of an herbaceous understory may foster use of restored old-age long leaf pine (*Pinus palustris*) stands (Section 2.7.1.2) by red-cockaded woodpeckers by providing nearby foraging habitat (USFS 2005). In 2003, Entergy Corporation entered into a partnership with the National Wild Turkey Federation to maintain utility rights-of-way on the Homochitto National Forest using low-toxicity herbicides for the express purpose of producing a more open, grassy habitat (USFS 2003). Consequently, right-of-way maintenance would be expected to benefit the red-cockaded woodpecker.

Louisiana Black Bear - Threatened

It is likely that the Louisiana black bear *(Ursus americanus luteolus)* occurs on and in the vicinity of the Grand Gulf site and potentially could be initially affected by noise from cooling tower operation. However, if present, the bear likely has become accustomed to noise produced by the existing GGNS Unit 1 cooling tower. Thus, this potential effect from operation of the Grand Gulf ESP facility would be expected to be negligible. The Louisiana black bear may occur in the vicinity of transmission line rights-of-way (Section 4.4.3.1) but would not be expected to be affected by transmission line operation and right-of-way maintenance. Consequently, the potential impacts on the subspecies from facility and transmission line operation and right-of-way maintenance, as discussed in Section 5.4.1, would be negligible.

Gulf Sturgeon - Threatened

The gulf sturgeon *(Acipenser oxyrinchus desotoi)* has not been collected in the region of the Grand Gulf site; however, the Mississippi River is considered part of the historical range for the gulf sturgeon. Therefore, the reach of the river at the Grand Gulf site is likely to be used by the sturgeon as it migrates up and down the river. No known spawning areas for the gulf sturgeon exist near the Grand Gulf site, and thus it is unlikely that this area of the river is used by larval stages of the gulf sturgeon (68 FR 13370; FWS & GSMFC 1995; Ross 2001; NMFS 2004).

The end of the Baxter-Wilson transmission line right-of-way is no closer then 0.6 km (0.4 mi) to the Mississippi River. Thus, the potential impacts from transmission line operation and right-of-way maintenance of the transmission line rights-of-way would have no effect on the Mississippi River and Gulf Sturgeon.

Operation Impacts at the Proposed Site

The operational activities of the Grand Gulf ESP facility that could influence the juvenile and adult gulf sturgeon as they migrate through the area would include water removal from the Mississippi River via a water intake structure and discharge of water downstream. The proposed intake structure is estimated to have a through-screen velocity of less than 0.2 m/s (0.5 ft/s) (SERI 2005a). Juvenile and adult sturgeon could easily escape the planned through-screen velocity at the plant's intake structure and would not become impinged on the screens. The thermal plume created from the discharge of blowdown water from the proposed plant would not likely influence the migration of the sturgeon. The plume is estimated to have a width of 8 to 387 m (26 to 1270 ft), which varies based on the season. The impacts on sturgeon from such elevated temperatures are not known (Beitinger et al. 2000). However, the juvenile and adult stages of the sturgeon could easily avoid the thermal plume if the temperature were too high. Consequently, impacts on gulf sturgeon from operation of the Grand Gulf ESP facility would be unlikely.

Bayou Darter - Threatened

The bayou darter (*Etheostoma rubrum*) is endemic to Bayou Pierre and its tributaries, which flow as close as 3 km (1.9 mi) east of the Grand Gulf site (40 FR 44149; FWS 1990, 2000; 2004a, Ross 2001). The operation of a Grand Gulf ESP facility would not affect the regions where the bayou darter is found. The Franklin transmission line right-of-way crosses Bayou Pierre. The NRC expects that an applicant for a CP or COL referencing the Grand Gulf ESP would work with the appropriate Federal and State agencies and the transmission line owner, Entergy Mississippi, Inc., to develop and implement plans for maintenance of the transmission line rights-of-way that would have minimal impacts on the Mississippi River and bayou darter.

Fat Pocketbook Mussel - Endangered

The fat pocketbook mussel *(Potamilus capax)* was historically found throughout the Mississippi River drainage from Minnesota to Louisiana. In 2003, the mussel was found near Vicksburg in the Mississippi River, as well as south of the Grand Gulf Site (41 FR 24062; FWS 1989, 2000, 2004a, 2004b, 2004c; MNHP 2004c). The adult mussels are found in sand and mud as well as in stable substrates of fast flowing rivers. Little information is available on the reproduction of the fat pocketbook mussel; however, they are thought to be similar to other freshwater mussels. When the mussels reproduce, the sperm are released into the water column and the sperm are taken in by the female through siphoning. Fertilized embryos then develop inside the female mussel into a parasitic stage (glochidia). Upon release from the female, the glochidia attach to a fish host and, after a period of time, metamorphose into a free-living juvenile. As the mussel matures, it settles into the sand and mud or onto a stable substrate to grow into an adult. The fat pocketbook mussel population is thought to be a long-period breeder, spawning in summer, retaining glochidia through fall and winter, and releasing them in late spring and early summer. Gravid females have been found from June through October (CMI 1996).

The end of the Baxter-Wilson transmission line right-of-way is no closer than 0.6 km (0.4 mi) to the Mississippi River. Thus, the potential impacts from transmission line operation and right-of-way maintenance of the transmission line rights-of-way would have no effect on the Mississippi River and fat pocketbook mussel.

Operation of the Grand Gulf ESP facility would include water removal from the Mississippi River via a water intake structure and discharge of water downstream. While the intake screens would be sized so that the through-screen velocity is less than 0.2 m/s (0.5 ft/s) (SERI 2005a), the sperm and free-living juvenile stage of the mussel could be entrained by the water intake system of the proposed plant. The area influenced by the flow into the intake structure is not great in comparison to the entire region of the Mississippi River where the mussel might occur. Not enough is known about the mussel's life history to determine if the increased temperature within the discharge plume of the proposed plant would have any impact; however, it would be highly unlikely. The area that would be affected by the increased temperature from the discharge plume is small and the warmer water is buoyant and would not normally impinge on the river bottom. It is likely that the impact of a thermal discharge from a new nuclear facility would be minimal because the region of the shoreline habitat in the Mississippi River that would change with operation is small compared to the entire shoreline habitat available for this species.

Pallid Sturgeon - Endangered

Pallid sturgeon *(Scaphirhynchus albus)* have been collected in the region of the Grand Gulf ESP site. Adult pallid sturgeon have been caught in regions with moderate to strong currents and a sand or sand/gravel substrate, similar to the main channel of the Mississippi River as it passes by the Grand Gulf site. Little is known about the use of the Mississippi River in the area of the Grand Gulf ESP site for spawning by the pallid sturgeon. Spawning habitat may exist within 16 km (10 mi) of the Grand Gulf ESP site. There also is little information about the use of the reach by larvae or juvenile pallid sturgeon (55 FR 36641; FWS 1993, 2000, 2004a; Ross 2001; Hartfield 2003; LDOTD 2003; SERI 2005a).

The end of the Baxter-Wilson transmission line right-of-way is no closer than 0.6 km (0.4 mi) to the Mississippi River. Thus, the potential impacts from transmission line operation and right-of-way maintenance of the transmission line rights-of-way would have no effect on the Mississippi River and pallid sturgeon.

The operation of the Grand Gulf ESP facility in the vicinity of the pallid sturgeon's habitat would include water removal from the Mississippi River with a water intake structure and discharge of water downstream. The adult and juvenile sturgeon would likely not be impinged on the screens of the intake structure because they would easily be able to avoid impingement from the anticipated through-screen velocity of water (less than 0.2 m/s (0.5 ft/s)). Larval sturgeon (less than 3 cm (1.2 in.) in size) are thought to drift along the bottom of the river (less than 0.5 m (1.6 ft) from the bottom) at the velocity of the river (Braaten and Fuller 2005).

Discharge at the downstream structure would create a thermal plume that might affect the passage of pallid sturgeon on the eastern shore of the Mississippi River. If the sturgeon, at any life stage, were to drift through the thermal plume at the average velocity of the river, the individual would spend from 13 seconds to 15 minutes at temperatures 2.8°C (5°F) or more above ambient temperature. The estimate of residence time in the plume is based on a river velocity of 0.4 to 0.6 m/s (1.3 to 2 ft/s) (SERI 2005a) and a thermal plume estimated by staff to have a length of 8 to 387 m (26 to 1270 ft), which varies with the season. The impact on sturgeon from such elevated temperatures is not known (Beitinger et al. 2000). However, the juvenile and adult stages of the sturgeon could easily swim and avoid the thermal plume if the temperature were too high. There are no known spawning areas in the reach of the Mississippi River that would be influenced by the thermal plume, and thus the number of larval pallid sturgeon in this area of the Mississippi is likely to be low. If the higher temperatures are detrimental, the larval stages of the pallid sturgeon that are drifting with the river current could become disoriented, but the temperature increase would not likely be lethal (Beitinger et al. 2000). Furthermore, based on the staff's analysis, the thermal plume is buoyant and does not extend more than 1 m (3 ft) below the water surface. Drifting pallid sturgeon larvae would, if present, be found near the bottom of the river (Braaten and Fuller 2005) and would not be affected by the thermal plume. Therefore, the impacts on pallid sturgeon from the discharges at the Grand Gulf ESP plant would likely be minimal.

5.4.3.2 Federally Listed Plant Species

No impacts on Federally listed or proposed threatened or endangered plant species–either terrestrial or aquatic–are anticipated from operation of the Grand Gulf ESP facility because no such plant species are known to occur on or within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b; FWS 2004a).

5.4.3.3 Summary of Threatened and Endangered Species Impacts

Because SERI is not planning any preconstruction ground disturbing activities as a result of the ESP, no Section 7 consultation with FWS or NOAA Fisheries is required at this time. However, the issuance of a CP or COL is a separate action requiring a consultation with the appropriate agency, pursuant to Section 7 of the Endangered Species Act.

The staff concludes the impacts on terrestrial and aquatic Federally listed threatened and endangered species from operation of the Grand Gulf ESP facility would be SMALL, and additional mitigation would not be warranted. The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include the current occurrence of Federally listed threatened and endangered species and critical habitat in the project area, the current listing status of such species, and the current designation of critical habitat.

5.5 Socioeconomic Impacts

The socioeconomic impacts from operating the Grand Gulf ESP facility and from the activities and demands of the operating workforce on the surrounding region include the potential impacts on individual communities, the surrounding region, and minority and low-income populations. To assess the potential impacts of operations, the staff evaluated the physical impacts, population impacts, and impacts on community characteristics.

5.5.1 Physical Impacts

The potential physical impacts on the nearby communities resulting from operation of the new unit or units includes noise, odors, exhaust, thermal emissions, and visual intrusions.

5.5.1.1 Workers and Local Public

The town of Port Gibson, located about 10 km (6 mi) southeast of the Grand Gulf site, is a small rural community that includes small businesses, houses, and farm buildings and has a population of 1840, according to the 2000 U.S. Census (USCB 2004c). Because of Port Gibson's distance from the Grand Gulf ESP site, its residents would not experience any physical impact from operation of the new unit or units.

The new unit or units would produce noise from the operation of pumps, transformers, turbines, generators, and switchyard equipment. The noise levels would be controlled in accordance with applicable local regulations. Most equipment would be located inside structures, reducing the outdoor noise level.

Two types of cooling systems will be considered for a new facility at the Grand Gulf ESP site: natural draft cooling towers and mechanical draft cooling towers (SERI 2005a). Natural and mechanical draft cooling towers emit broadband noise. Therefore, the noise associated with the cooling towers would be largely indistinguishable and nonobtrusive. The anticipated noise levels from either of the cooling tower options are not expected to be significantly greater than background levels. Noise levels below 60 to 65 dBA are not considered to be significant because these levels are not sufficient to cause hearing loss (NRC 1996).

Based on the PPE (see Appendix I), both natural and mechanical draft cooling towers have anticipated noise levels of 55 dBA at 300 m (1000 ft). The proposed location of the cooling towers would place them approximately 300 m (1000 ft) from the nearest site boundary on the north side of the property. The resulting operational noise level from the addition of a new unit or units would not significantly increase the noise level at the property line. Therefore, the noise level at the property line is expected to remain below the limit of 65 dBA recommended in NUREG-1555 (NRC 2000a). In general, power plant sites do not result in offsite noise level increases of more than 10 dBA above background levels. Therefore, background noise levels are expected to range from 45 to 55 dBA at the nearest site boundary.

Noise levels below 60 to 65 dBA are considered to be of SMALL significance (NRC 1996). Therefore, the noise impact at the nearest residence would be SMALL and no mitigation would be warranted.

Ambient noise heard by recreational users of Grand Gulf Military Park under normal conditions includes some noise from the GGNS Unit 1 plant. The noise level generated by the operation of the new unit or units would not affect the recreational use of Grand Gulf Military Park.

In Section 2.7 of NRC Regulatory Guide 4.2 (NRC 1976), the staff states that an assessment should be made of the ambient noise level within 8 km (5 mi) of any proposed nuclear facility. Particular attention is directed toward obtaining acoustic levels associated with high voltage transmission lines. An assessment of the impact from the transmission system would be studied at a suitable time within future planning work and after a decision has been made to proceed with the new additional capacity.

The new unit or units would have standby diesel generators and auxiliary power systems. Air permits acquired for these generators would ensure that air emissions comply with regulations. In addition, standby diesel generators would be operated on a limited short-term basis.

5.5.1.2 Buildings

Operations activities would not affect any offsite buildings. Onsite buildings have been constructed to safely withstand any possible impact, including shock and vibration, from operations activities associated with the proposed activity. Except for GGNS Unit 1 structures, no other industrial, commercial, or residential structures would be directly affected by the operation of a new ESP facility.

5.5.1.3 Roads

Commuter traffic would be controlled by speed limits. The access roads to the Grand Gulf ESP site would be paved. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the Grand Gulf site.

5.5.1.4 Aesthetics

The nearest residential area is about 500 m (1650 ft) from the Grand Gulf ESP site and is shielded by woods. Given this distance, residents near the site would not have a clear view of the new unit or units. Some structures of the new facility may be visible from the Mississippi River (for example, intake structure, cooling towers) and from Grand Gulf Military Park. Bluffs on the site east of the Mississippi River are about 20 m (65 ft) above the average river level (Entergy 2003c), and dense forest throughout the vicinity would help conceal the new structures.

The reactor design and ancillary facilities (cooling water system) have not yet been selected. The natural draft cooling towers, if used, would be up to 168 m (550 ft) tall, so some visual impact would result. However, the existing cooling tower at GGNS is similar in height and is difficult to see from most vantage points offsite. Mechanical draft cooling towers would be considerably shorter: 18 m (60 ft). Either type of tower would generate a visible water vapor plume. Longest visible plumes would occur in the winter with an estimated average length of 3.71 km (2.32 mi) for natural draft cooling towers and 2.18 km (1.36 mi) for mechanical draft cooling towers (SERI 2005a). Because the Grand Gulf ESP site is already aesthetically altered by the presence of an existing nuclear power plant (GGNS Unit 1) with a natural draft cooling tower along with its visual plume, only slight adverse impacts on visual aesthetics of the site and vicinity are expected from the operation of a new facility.

As stated in Section 5.4.2, the full extent of the changes in the transmission system cannot be known until SERI initiates the Federal Energy Regulatory Commission process for connecting new large generation plants to the grid. If, as assumed in Section 4.4.1, existing transmission line rights-of-way are used, even significant widening of these rights-of-way and building of new transmission towers is unlikely to have more than a minor effect on visual aesthetics.

During normal plant operation, the new unit or units would not use a large amount of chemicals that would generate odors exceeding the odor threshold value.

5.5.1.5 Summary of Physical Impacts

Based on the information provided by SERI, staff interviews with local public officials, and its own independent review, the staff concludes that the physical impacts of operation of the new unit or units at the Grand Gulf ESP site would be SMALL, and additional mitigation measures beyond those identified by SERI would not be warranted.

The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include mitigative actions identified to reduce physical impacts such as: cooling tower plume control; compliance measures to control noise, dust, and other air pollutants; and traffic management identified by SERI are undertaken.

5.5.2 Demography

The demographic impacts from the operation of a new unit or units at the Grand Gulf ESP site would be associated with employment related to the daily operation of the new unit(s) and with resulting effects on the surrounding region.

According to the SERI environmental report, approximately 1160 workers (SERI 2005a) would be required for the operation of the new unit or units, about 50 percent more than are currently required for the existing GGNS Unit 1. A conservative estimate of 50 percent of these would be expected to in-migrate to the region, accompanied by their families. Assuming an average family size of four, 2320 people could be expected to move to the region from other areas and would represent both a source of income to the community and a potential demand on community services, such as schools and police protection.

The expected number of permanent workers needed to operate the new unit or units and their families generally would be a small fraction of the total projected population growth in the region. Assuming that the geographic distribution of new employees would be the same as for the existing unit, Table 5-4 shows the potential geographic distribution of new employees and the potential percentage increase for each jurisdiction's population represented by facility-related population if facility operations started today. Proportionally more new migrants, however, are expected to reside in the Vicksburg area rather than in Port Gibson because of the wider availability of housing and services in Vicksburg (SERI 2005a).

Table 5-4. Potential Increase in Resident Population Resulting from Operations at the Grand Gulf Early Site Permit Site

Jurisdiction	Percent of Current GGNS Workforce by Location	ESP Facility-Related Increase in Population	Year 2000 U.S. Census Population	Percentage Increase in Resident Population	ESP Facility-Related Households	Year 2000 Vacant Housing Units
Vicksburg	46.4	1,076	26,407	4.1	269	1,290
Port Gibson	14.6	339	1,840	18.4	85	95
Other locations						
Clinton	7.3	169	23,347	0.7	42	571
Fayette	3.9	90	2,242	4.0	22	68
Natchez	3.3	77	18,464	0.4	19	888
Brookhaven	2.7	63	9,861	0.6	16	430
Jackson	2.7	63	184,256	0.0	16	7,837
Wesson	2.3	53	1,693	3.1	13	41
Hazelhurst	1.7	39	4,400	0.9	10	158
All Other	15.1	350	NA	NA	88	NA
Total	**100.0**	**2,319[(a)]**			**580**	

(a) Difference between total of 2319 and SERI (2005a) assumption of 2320 is due to rounding.
ESP = early site permit
GGNS = Grand Gulf Nuclear Station
NA = not available
Source of resident locations: SERI 2004a
Source of Year 2000 U.S. Census Population: USCB 2004c

Based on the information provided by SERI, staff interviews with local public officials, and their own independent review, the staff concludes that the demographic impacts of operation of the new unit or units at the Grand Gulf ESP site on most of the region would be SMALL. However, if Port Gibson, Mississippi, were to attract new in-migrating population in the same proportion as existing facility employees, the town would experience an 18 percent population increase, which would be a LARGE demographic impact.

The conclusion regarding the range of impacts by the NRC staff is predicated on certain assumptions made by the staff. These include not more than 1160 new operations workers at the Grand Gulf ESP site, not less than 50 percent of the operations workers would come from the region within 80 km (50 mi) of the Grand Gulf site, and most of the new workers would choose to live in the larger cities of the region.

5.5.3 Social and Economic Impacts

The social and economic impacts on the surrounding region as a result of operating the Grand Gulf ESP facility were evaluated, assuming a 40-year operating license term.

5.5.3.1 Economy

The main economic impacts resulting from new workers and their families on the area would be related to taxes, housing, and requirements for goods and services. Economic impacts related to the operation of the new unit or units would be associated mainly with payment of the plant property taxes.

A detailed description of local and regional employment trends is provided in Section 2.8. Annual 2004 county labor force data indicate that Claiborne County has an unemployment rate of 10.1 percent (Section 2.8.2.1). General trends for Claiborne and the contiguous counties indicate the total number of jobs across many of the surveyed industries have decreased from 1990 to 2000 (USCB 2004a, 2004b). Operation of a new ESP facility could generate jobs for the residents of the area. The addition of 1160 permanent workers traveling into the area would also increase demand for commercial retail establishments, which would provide some additional employment. The overall impact on the economy of the region (including Claiborne County and surrounding counties–especially Vicksburg and Warren County) would be positive.

5.5.3.2 Taxes

The assessed value of the new unit or units would exceed that of the existing GGNS unit, which has depreciated with time. It is not possible at this time to estimate the actual taxes that would be paid to the regional governments or the expenditures regional governments would incur to accommodate the workforce. The expenditures by the regional governments would, in part, be related to the size and age distribution of the families of the new employees. Based on the assumption that the new employees would come from outside the region, the regional governments would experience both outflows and inflows of monies as a result of the operation of the new unit or units. Expenditures would be related to the impact on the local and regional infrastructure because of the increased use of the school, recreational, medical, fire and police, and transportation systems. The types of taxes and their bases can be addressed and are presented below.

Sales, Use, and Income Taxes

Sales, use, and income taxes would be generated by retail expenditures (restaurants, hotels, and merchant sales) of operations workers. Although there is a small local sales and use tax, the State would collect most of these, both from individual workers and from corporate entities in the general region of the site. No estimate is available of the day-to-day expenditures during operations that would occur in the region.

Property Taxes

The jurisdictions shown in Table 5-4 would benefit from additional property tax revenues from two sources associated with the Grand Gulf ESP facility: property tax on the new unit or units and property tax on land owned by the new employees. Because of the manner in which Mississippi treats the tax base of nuclear power facilities, local property taxes might or might not be levied for the increase in value of the Grand Gulf site because of the new unit or units. The property tax payments to Claiborne County are discussed in Sections 2.8 and 4.5, and are identified as a potential beneficial impact for the state of Mississippi or for Claiborne County, depending on tax treatment of the new plant. The addition of the new unit or units to the Grand Gulf site would substantially increase the property tax payments in the State.

The existing GGNS unit has contributed 83 percent of the property taxes paid to Claiborne County over the past decade. The construction and operation of a new nuclear unit or units are expected to maintain the very high percentage of the property taxes in Claiborne County paid by Entergy.

The potential effect of future electric utility deregulation within Mississippi is not known. However, if Mississippi were not to regulate the Grand Gulf ESP facility as a public utility, it is reasonable to conclude the facility could be treated as an ordinary corporate asset subject to normal local property taxation. If so, the new unit or units would result in a substantial increase in property tax payments to Claiborne County.

If the final capital cost were in the range of $1000 per installed kilowatt, the maximum capacity 3000 MW(e) facility would (at completion) have an approximate capital value of $3 billion. At Claiborne County's current property tax rate of 65.01 mills and 15 percent assessment ratio for nonresidential property (SERI 2004a), the tax yield would be about $29 million per year, a very significant positive impact. Even if the new nuclear facility were taxed and the funds distributed as with the existing GGNS, the payment in lieu of taxes to Claiborne County would be about $7.8 million per year, increasing county revenues by about 83 percent, still a LARGE effect. Other nearby counties would see much smaller benefits from other taxes. The expected impacts on the economy and tax revenues in Claiborne County would be LARGE and beneficial.

The conclusion of LARGE beneficial impacts in Claiborne County is predicated on certain assumptions made by the staff. These include not more than 1160 new operations workers would be employed at the Grand Gulf ESP site, not less than 50 percent of the operations workers would come from the region within 80 km (50 mi) of the Grand Gulf site, most of the new workers would choose to live in the larger cities of the region, and there are no significant changes in the terms and conditions for taxability of real property under Mississippi tax law.

5.5.3.3 Summary of Social and Economic Impacts

Based on the information provided by SERI, staff interviews with local public officials, and its own independent review of data on the regional economy and taxes, the staff concludes that the impacts on the regional economy of operating the new unit or units at the Grand Gulf ESP site on most of the region would be SMALL, with a possible MODERATE beneficial impact in Warren County. Under current Mississippi tax law, it appears that Claiborne County would receive annual property taxes or payments in lieu of taxes equal at least to an increase of $7.8 million (83 percent of the current county budget) and perhaps much more, depending how the new plant would be treated for tax purposes. Taken together with the jobs created in the region, this would be a LARGE beneficial impact in Claiborne County.

The conclusion of LARGE beneficial impacts by the NRC was predicated on certain assumptions made by the staff; these include: that there would be no more than 1160 new operations workers at the Grand Gulf ESP site; that no less than 50 percent of these workers would come from the 80-km (50-mi) region surrounding the site; that new workers would tend to live in the larger communities in the region; and that there are no significant changes in Mississippi tax law, especially the terms and conditions for taxability of real property. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there would be any new and significant information that would change this conclusion.

5.5.4 Infrastructure and Community Services

Infrastructure and community services include transportation, recreation, housing, public services, and education.

5.5.4.1 Transportation

Roads within the vicinity of the Grand Gulf ESP site would experience a temporary increase in traffic at the beginning and the end of the workday period. However, the current road network has sufficient capacity to accommodate the increase, as discussed in Section 4.5.4.1. Section 4.5.4.1 shows a number of permanent changes to the regional and local transportation network that would reduce any potential adverse impacts generated by the influx of 3150 construction workers during construction of one or more new units. These permanent changes would also reduce or eliminate any potential adverse impacts that could be generated by the operating workforce of 1160 for the new unit or units, 50 percent of whom are expected to have relocated with their families into the region.

5.5.4.2 Recreation

The facility-related population increase in the potentially affected counties is expected to be about 2320 people. To accommodate normal increases in population, which are expected to be much larger, the surrounding counties would need to address and fund new recreational areas as they update their comprehensive plans. The GEIS (NRC 1996) concludes the impacts of existing employees and their families on parks and other recreational areas within a typical region are small. This conclusion likely would also apply to the employees of the new ESP unit or units and their families who would relocate to the area because they represent a small fraction of the projected population growth for the area.

A detailed description of local tourism and recreation is provided in Section 2.8. Because of the proximity of the Grand Gulf Military Park to the north of the Grand Gulf ESP site, it is possible that increased traffic resulting from the influx of site workers would indirectly affect the traffic flow to Grand Gulf Military Park, and that there would be minor effects on noise and visual aesthetics in the park. However, the majority of tourists visit the park on the weekends when fewer people report for work at the Grand Gulf ESP site (SERI 2004a, Attachment 14). In addition, the traffic associated with the Grand Gulf site is limited to specific times of the day, during shift changes, which would minimize the impact of potential Grand Gulf ESP site traffic on the Grand Gulf Military Park. Case studies conducted during operation of several nuclear power facilities indicated no adverse impacts on local tourism and recreation as a result of the operation of existing nuclear power plants (NRC 1996).

5.5.4.3 Housing

The number of housing units required to support the expected permanent workforce migrating into the area would be 580, half of the 1160 new employees (see Table 5-4). In Port Gibson, plant-related migration would absorb a substantial portion of the vacant housing stock, if today’s residence pattern of GGNS workers were the same for new workers and if the population increase were to happen today. There is no accurate way to estimate the number of housing units that would be available in the region in the year 2030, the year a new ESP facility would be expected to begin operations (SERI 2005a). However, the counties in the vicinity of the Grand Gulf ESP site and within the region are addressing the needs of the projected increases in population and an adequate number of units likely would be available, especially in the larger towns. Little new housing seems to have been recently added in Claiborne County, as discussed in Section 5.1.1, although nearby larger communities are keeping pace with housing demand (Scott 2004). Because the new workforce incomes would be high relative to other incomes in the region, it can be expected that the housing purchases would be on the high end of the price range. The new workers and their families would be about 9.4 percent of the population growth SERI (2005a) has projected for the area within 80 km (50 mi) over the next 30 years (Table H-2 in Appendix H). Therefore, the impact of the property taxes paid for housing by these families overall would be a small benefit to the region, but possibly locally more important in Port Gibson and Vicksburg, Mississippi, if they concentrate in those cities.

Currently, 100 to 200 additional outage workers conducting refueling of the GGNS Unit 1 reactor are onsite for a period of 30 to 40 days per outage (SERI 2005a). It is expected the planned outages for the new unit or units would be scheduled so that multiple units would not be worked on simultaneously. This would also reduce the potential for exceeding the availability of short-term housing in the immediate vicinity of the Grand Gulf ESP site. The temporary outage staff for the existing GGNS typically stays in area hotels or manufactured home and recreational vehicle parks dispersed throughout the region. Therefore, no single community would be overburdened by the influx of temporary workers. It is expected that the increased frequency of the temporary outage staff would not significantly affect the region.

5.5.4.4 Public Services

Water Supply and Waste Treatment

Detailed information regarding the current sewer and water services available at the Grand Gulf site is provided in Section 2.8.2.6. SERI currently operates an onsite water and sewer system for treatment of sanitary waste from GGNS Unit 1. Additional water and sewage treatment facilities would be constructed as part of a new facility to support future operations. However, the designs for water and sewer treatment facilities for the ESP facility have not been selected. Because a new facility would use onsite water and sewer services, the operation of a new facility at the Grand Gulf site would not burden public utilities in surrounding communities. In general, case studies indicate minimal impact on public utilities resulting from plant operation (NRC 1996).

The in-migration of additional employees and their families would increase the demand for public utilities in the communities where these employees reside. As was the case with the construction of GGNS Unit 1, it is expected these workers would reside in or around the more populous areas such as Vicksburg, Mississippi, because of the public utilities and other services available. The water and sewer services in Vicksburg are currently at 70 percent of total capacity (SERI 2004a). Therefore, the addition of plant personnel to this or other comparable communities would not be expected to overburden public utilities. The possible exception would be Port Gibson where, if population increased by 18.4 percent (Table 5-4), water use could increase to close to the maximum capacity of the system. Because operational staff in-migrating to the region for a new facility would likely settle in numerous surrounding communities, the potential impacts on public utilities of any one community would be expected to be minimal. Increases in sales, property, and income taxes generated by the population in-migrating to specific communities would at least partially offset costs associated with any upgrades a community may find necessary. The impacts of relocated families on these water and sewer systems would not be significant.

Police, Fire, and Medical

The police and fire departments within 16 km (10 mi) of the Grand Gulf ESP site are part of the existing emergency response plan for the existing GGNS Unit 1. The Claiborne County Sheriff and other local police departments are responsible for the proper evacuation of the area in the event of an emergency at the Grand Gulf site. This would continue to be the case should the new unit or units become operational. Despite the transfer of funds from the State government to Claiborne County, there is substantial local concern about the adequacy of emergency resources to implement the current evacuation plan and the ability of local officials to carry it out (Scott 2004).

The nearest medical facilities generally consist of local physicians' offices and the 32-bed hospital in Port Gibson, Mississippi. However, major medical facilities are available in Vicksburg, Natchez, and Jackson, Mississippi. These facilities are readily accessible to county residents and have held successful emergency drills with the GGNS. The surrounding counties assess the need for additional medical, fire, and police facilities and add new facilities or expand existing facilities as needed. For example, the Warren County hospitals and medical facilities recently have accommodated economic and population growth from 1800 new jobs at two Japanese-owned companies (Scott 2004). The increase of 580 (half of the total 1160) new resident employees and their families would represent a small fraction of the expected population growth in the multi-county region around the Grand Gulf ESP site. However if new residents were to concentrate in Claiborne County, the increase in Claiborne County population might be quite significant relative to the current population. Therefore, while in general no unforeseen demands on medical facilities would result from the operation of the new unit or units, there may be increased demands for beds in Port Gibson's hospital as well as increased hours of operation. Financing the potential hospital upgrades would require additional revenue (Scott 2004).

Detailed information concerning the capacity of the hospitals in Claiborne County and the adjacent Mississippi counties is provided in Section 2.8.2.6. It is expected that a majority of the future employees will reside in more populous areas located in neighboring counties (for example, Vicksburg, Warren County). Therefore, the influx of plant workers is not expected to overburden Claiborne County health or social services. Case studies of several nuclear power plants show only a small impact on local social services associated with the influx of plant workers (NRC 1996).

5.5.4.5 Education

Table 2-18 shows the number of schools within the Mississippi counties surrounding Claiborne in the Grand Gulf ESP site area. As was the case with GGNS Unit 1, new workers would likely move to the more populous areas in the surrounding communities where they would have access to more developed public services. Workers with school-aged children would be interested in communities with good school districts. The largest school district near the Grand Gulf ESP site is in Vicksburg, Mississippi. The current student population at Vicksburg is 9180 (NCES 2002). Given sufficient lead times, school officials in Warren County are not concerned about absorbing the potential increase in students (Scott 2004). The impact on Vicksburg schools would likely be small.

Port Gibson has only 2011 students (Section 2.8.2.7). If 14.6 percent of new workers moving to the area located in Port Gibson and their family size is assumed to be four (two of whom are students), the impact in Port Gibson would be 169 students, an 8.4 percent increase. This would be a moderate impact (assuming some impact assistance from the State) on Port Gibson schools were it to happen. Part of this increase could be absorbed by private schools located in the area. Any adverse impact on local school districts because of the influx of plant workers into a community would likely be at least partially offset by increased sales, personal property, and income tax revenues paid by facility personnel. Overall, the impacts on education in Claiborne County would be moderate.

5.5.4.6 Summary of Infrastructure and Community Services

Based on information supplied by SERI, staff interviews conducted with public officials in Claiborne, Jefferson, and Warren counties, and staff review of data concerning the current availability of services and current state and community planning efforts, the staff concludes that the operation impacts on the regional infrastructure and community services would be SMALL in most of the region. The estimated workforce of 1160 persons would have a SMALL effect on the transportation network in the vicinity and region because several permanent transportation mitigation measures are being implemented that will remove most remaining bottlenecks. The site is relatively isolated, industrial in nature, and well masked by forest in most directions so the impacts on aesthetics would be SMALL, as would the impacts on recreation. The impacts on public services and infrastructure would be SMALL throughout the region, unless Claiborne County draws a substantial share of the in-migrating operations workforce, which is not expected. In that case, the impacts on housing and education in Claiborne County could be MODERATE.

The conclusion of MODERATE impacts by the NRC was predicated on certain assumptions made by the staff; these include: that there would be no more than 1160 new operations workers at the Grand Gulf ESP site; that no less than 50 percent of these workers would come from the 80-km (50-mi) region surrounding the site; that new workers would tend to live in the larger communities in the region (but could still result in a significant relative increase of population in Claiborne County); and that the state would provide some financial help if the school system were seriously affected by in-migration. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there is any new and significant information that would change this conclusion.

5.5.5 Summary of Socioeconomic Impacts

Based on information supplied by SERI, staff interviews conducted with public officials in Claiborne, Jefferson, and Warren counties concerning the current availability of services, and additional taxes that would likely compensate the need for additional services, the staff concludes that the operations impacts on the local economy would be beneficial and SMALL in most of the region and probably MODERATE and beneficial in Warren County (Vicksburg). The estimated workforce of 1160 would have a SMALL effect on the transportation network in the vicinity and region because permanent transportation mitigation measures proposed for the construction of the new unit or units would also result in much reduced transportation-related impacts during operation of the new unit or units. The effect on tax revenues would be beneficial and SMALL except for property tax receipts in Claiborne County, which could be beneficial and LARGE. The site is relatively isolated, industrial in nature, and well masked by forest in most directions so the impacts on aesthetics would be SMALL, as would the impacts on recreation. The impacts on public services and infrastructure would be SMALL throughout the region, unless Claiborne County draws a substantial share of the in-migrating construction workforce, which is not expected. In that case, the impacts on housing and education in Claiborne County could be MODERATE and adverse, but more than likely would be more than offset by LARGE tax receipts.

The conclusion of LARGE to SMALL beneficial impacts and SMALL to MODERATE adverse impacts by the NRC staff is predicated on certain assumptions made by the staff. These include not more than 1160 new operations workers would be employed at the Grand Gulf ESP site, not less than 50 percent of the operation workers would come from the region within 80 km (50 mi) of the Grand Gulf site, most of the new workers would choose to live in the larger cities of the region, and there are no significant changes in Mississippi tax law, especially the terms and conditions for taxability of real property.

5.6 Historic and Cultural Resources Impacts

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The National Historic Preservation Act of 1966 (NHPA), as amended through 1992, also requires Federal agencies to consider impacts on those resources if they are eligible for listing on the National Register of Historic Places (such resources are referred to as "Historic Properties" in NHPA). As outlined in "Coordination with the National Environmental Policy Act," 36 CFR 800.8, the NRC is coordinating compliance with Section 106 of the NHPA in meeting the requirements of NEPA.

Because all ground-disturbing activities that could have an impact on historic or archaeological resources would probably occur during the construction phase, there would be limited potential for impacts during operation of one or more additional units at the Grand Gulf ESP site. The NRC staff therefore concludes that the potential impacts on historic and cultural resources would be SMALL. The conclusion of SMALL impacts by the NRC staff is predicated on the assumption that SERI will develop procedures regarding protection of historic and cultural resources that would be incorporated into the site-wide Excavation and Backfill Work Procedures, which will involve an immediate stop work order should archaeological, historical, or other cultural resources be uncovered during excavation. The construction supervisor would be responsible for ensuring the work stoppage and for notifying the Environmental Compliance Coordinator of an inadvertent discovery. If such a discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would consult with him or her in conducting an assessment of the discovery to determine if additional work is needed. If an applicant submits a CP or COL application referencing this ESP, the NRC staff's review of such an application would be a separate undertaking requiring further consultation pursuant to Section 106 of the NHPA.

5.7 Environmental Justice Impacts

Environmental justice refers to a Federal policy under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040). Section 2.10 discusses the locations of minority and low-income populations around the Grand Gulf ESP site and within the 80-km (50-mi) radius.

As discussed in Section 4.7, the staff examined the geographic distribution of minority and low-income populations recorded during the 2000 U.S. Census (USCB 2004b, 2004c) within

80 km (50 mi) of the Grand Gulf ESP site, encompassing 25 counties and parishes. The analysis was also supplemented by field inquiries and outreach to the planning department and social service agencies in Claiborne, Warren, and Jefferson counties.

Specifically, in the case of the Grand Gulf ESP, announcements of public meetings were made in the Port Gibson Reveille and Jackson Clarion-Ledger. Press releases announcing the meetings were forwarded to the Arkansas Democrat, the Columbus (MS) Telegram, Jackson (MS) Clarion-Ledger, Port Gibson (MS) Reveille, and Vicksburg (MS) Post newspapers, and to WJTV (Jackson) and WVUE-TV (New Orleans). In addition to public meetings, at the request of staff, the local county governments invited a number of local government and social services officials to additional meetings that were held in Port Gibson, Fayetteville, and Vicksburg.

Minority and low-income areas identified from the census block group data are shown graphically in Figures 2-12 and 2-13, respectively. However, it is also clear from examining census block group data that most of the counties and parishes within 32 km (20 mi) of the Grand Gulf ESP site have large African-American populations, whether or not they meet the usual plus-20 or -50 percent criteria.

The scope of the review as defined in NRC guidance (NRC 2001, 2004b; 69 FR 52040) should include an analysis of the impacts on minority and low-income populations, the location and significance of any environmental impacts during operations on populations that are particularly sensitive, and any additional information pertaining to mitigation. The descriptions to be provided by this review should state whether the impacts are likely to be disproportionately high and adverse. The review should also evaluate the significance of such impacts.

With the locations of minority and low-income populations identified, the staff proceeded to evaluate whether the environmental impacts of the proposed action could affect these populations in a disproportionate manner. Based on staff guidance (NRC 2001, 2004b; 69 FR 52040), air, land, and water resources within about 80 km (50 mi) of the Grand Gulf ESP site were examined. Within that area, potential environmental impacts could affect human populations. All physical environmental impacts would be SMALL, and the socioeconomic impacts would vary from LARGE beneficial to MODERATE adverse.

5.7.1 Environmental Impacts

The pathways through which the environmental impacts associated with the new unit or units could affect human populations are discussed in Sections 5.7.2 and 5.7.3. The staff evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual health conditions or resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected (see Section 2.10). In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations. The staff concludes that offsite impacts on minority and low-income populations from operating one or more new units at the Grand Gulf ESP site would be minor, and no additional mitigation would not be warranted.

The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include there will not be any significant demographic changes before additional units are added to the Grand Gulf site and there are no significant resource dependencies or pre-existing conditions among the minority and low-income population that have not been identified.

5.7.2 Human Health Impacts

Operation of the new facility would result in slight contributions to radiation dose to members of the public living in the vicinity of the site, far below that associated with natural radiation background levels.

As presented in Section 5.9, the critical pathways to humans for routine radiation releases from facilities at the Grand Gulf ESP site are exposure from air, inhalation of contaminated air, drinking milk from a cow that feeds on open pasture near the site, eating vegetables from a garden near the site, and eating fish caught in the Mississippi River. The results of the normal operation dose assessments indicate that the maximum individual dose for these pathways was found to be insignificant, well below the regulatory guidelines in Appendix I of 10 CFR Part 50 and the regulatory standards of 10 CFR Part 20.

The evaluation of postulated accidents is provided in Section 5.10 and demonstrates that radiological consequences of these accidents would meet the site acceptance criteria of 10 CFR 50.34 and 10 CFR Part 100 for the exclusion area boundary and low population zone boundary. In demonstrating compliance with these criteria, an adequate level of protection would be provided. There would be no significant adverse health impacts on members of the public, and, therefore, there would be only minimal negative and disproportionate health impacts on minority and low-income members of the public.

The conclusion of SMALL impacts by the NRC staff is predicated on certain assumptions made by the staff. These include there will not be any significant demographic changes before any additional units are added to the Grand Gulf site, regional populations of minority and low-income populations will remain in the same geographic locations, and there are no significant resource dependencies or pre-existing conditions among the minority and low-income population that have not been identified.

5.7.3 Socioeconomic Impacts

Potential adverse socioeconomic impacts during operations include potential adverse impacts on air quality, aesthetics, schools, transportation, public safety, social services, public utilities, and recreational resources. None of the potential physical impacts attributable to operation of a new facility were judged to be significant to most of the region. SERI would provide some additional revenues to support emergency services in Claiborne County and Port Gibson (see Section 5.1.1). However, depending on where new in-migrating employees decide to live, Claiborne County might have to upgrade several components of its social services and public utilities infrastructure. It is not clear how the new nuclear facility would be treated for property tax purposes, so it is not clear whether Claiborne County would receive property taxes, sales, and use taxes, or other taxes and public monies commensurate with the costs of its additional emergency management and public services obligations. However, under current Mississippi tax law, it appears that Claiborne County would receive at least $7.8 million per year if the new nuclear facility were treated the same as the existing GGNS, and considerably more if it were treated as an ordinary industrial asset. A LARGE net financial benefit would be realized by local residents and taxpayers, most of whom are minority and low-income persons.

The conclusion of LARGE beneficial impacts is predicated on certain assumptions made by the NRC staff. These include: not more than 1160 new operations workers would be employed at the Grand Gulf ESP site; not less than 50 percent of the operations workers would come from the region within 80 km (50 mi) of the Grand Gulf site; most of the new workers would choose to live in the larger cities of the region; there are no significant changes in the terms and conditions for taxability of real property under Mississippi tax law; and regional populations of minority and low-income populations will remain in the same geographic locations.

5.7.4 Summary of Environmental Justice Impacts

Taken together, the impacts of plant operations on environmental justice would be SMALL for environmental and human health impacts because no environmental pathways or health and other preconditions of the minority and low-income population were found that would lead to adverse and disproportionate impacts. The socioeconomic impacts would be LARGE and beneficial because local tax burdens and access to public services in Claiborne County would likely greatly improve, depending on the level of public sector obligations imposed by new residents and the level of tax revenues provided by the new units.

The conclusion of LARGE beneficial impacts is predicated on certain assumptions made by the NRC staff. These include not more than 1160 new operations workers would be employed at the Grand Gulf ESP site, not less than 50 percent of the operation workers would come from the region within 80 km (50 mi) of the Grand Gulf site, most of the new workers would choose to live in the larger cities of the region, there are no significant changes in the terms and conditions for taxability of real property under Mississippi tax law, and regional populations of minority and low-income populations will remain in the same geographic locations. The NRC staff would have to confirm these assumptions at the CP or COL stage and determine whether there is any new and significant information that would change this conclusion.

5.8 Nonradiological Health Impacts

This section discusses the nonradiological health impacts of operating the proposed new unit(s) at the Grand Gulf ESP site. Health impacts on the public from the cooling system, noise generated by unit operations, and EMFs are discussed. Health impacts from the same sources are also evaluated for workers at the new unit. The health impacts from radiological sources during operations are discussed in Section 5.9.

5.8.1 Thermophilic Microorganisms

The SERI environmental report (SERI 2005a) noted thermal discharges to the Mississippi River would result from the use of cooling towers. Such discharges have the potential to increase the growth of thermophilic microorganisms both in the cooling tower and river. The types of thermophilic microorganisms sometimes found where elevated moist temperatures exist are *Salmonella* sp., *Psudomonas aeruginosa*, *Legionella* sp., and free-living amoebae of the genera *Naegleria* and *Acanthamoeba*. Serious illness and even death can occur when there is high exposure to these microorganisms.

As described in the GEIS (NRC 1996), nuclear power plants that use cooling ponds, lakes, or canals and those that discharge to "small rivers" have the greatest chance of affecting the public from increases in thermophilic microbial populations. A small river is defined as one with an average flow rate of less than 2830 m^3/s (100,000 ft^3/s). The average flow of the Mississippi River between the years 1973 and 1999 was about 20,700 m^3/s (730,000 ft^3/s) (SERI 2005a) and, therefore, does not meet the criterion of a small river. GGNS Unit 1 and one or more new units would be discharging thermal effluent into the river. SERI reviewed data from the Center of Disease Control for the years 1991 through 2000 and found no incidences of waterborne diseases in Mississippi that were associated with the Mississippi River (SERI 2005a).

5.8.2 Noise

In the GEIS (NRC 1996), the staff discusses the environmental impacts of noise at existing nuclear power plants. Common sources of noise from plant operation include cooling towers, transformers, and loud speakers with intermittent contributions from auxiliary equipment. These noise sources are generally sufficiently distant from the plant boundaries that the noise generated by the plant is attenuated to near ambient levels before reaching critical receptors outside the plant boundary.

Operation Impacts at the Proposed Site

GGNS Unit 1 has a closed-cycle cooling system that uses a natural draft cooling tower. This system does not contribute significantly to noise at the plant site or at the plant boundary. SERI's environmental report (SERI 2005a) specifies that additional units at the proposed Grand Gulf ESP site would be cooled by wet cooling towers. If the ESP is approved and cooling towers are used at the site, the towers would be the primary noise source on the site in addition to the existing cooling tower for GGNS Unit 1.

Sound surveys made prior to startup of GGNS Unit 1 showed that ambient noise levels at the site generally varied from about 40 to 60 dBA during the course of a day (SERI 2005a). SERI (2005a) does not indicate any more recent sound surveys. Based on the PPE cooling tower noise level of 55 dBA at 300 m (1000 ft) for the existing cooling tower, the staff estimates that the background noise level at the exclusion area boundary closest to the postulated location for new cooling towers has increased by less than 1 dBA, an increase in the background noise level that would not be perceptible.

At its closest point of approach, the site fence line is approximately 300 m (1000 ft) from the postulated location of the cooling towers at the Grand Gulf ESP site. Using this distance, the PPE cooling tower noise specification and four linear mechanical draft cooling tower units, the noise level at the closest point on the fence line is expected to increase to about 62 dBA. The noise level at 500 m (1650 ft), the closest residence, would be less than 60 dBA, and the noise level at 800 m (0.5 mi) from the cooling towers is expected to be about 55 dBA. For context, Tipler (1982) lists the sound intensity of a quiet office as 50 dBA, normal conversation as 60 dBA, busy traffic as 70 dBA, and a noisy office with machines or an average factory as 80 dBA. Construction noise (at 3 m (10 ft)) is listed as 110 dBA, and the pain threshold is 120 dBA .

According to the GEIS (NRC 1996), noise levels below 60 to 65 dBA are considered to be of small significance. More recently, the impact of noise was considered in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, *Supplement 1 Regarding the Decommissioning of Nuclear Power Reactors* (NRC 2002a). In that document, the criterion for assessing the level of significance was not expressed in terms of sound levels. Rather, the level of significance was based on the effect of noise on human activities and threatened or endangered species. The criterion in NUREG-0586 Supplement 1 (NRC 2002a) is stated as follows:

> The noise impacts of... are considered detectable if sound levels are sufficiently high to disrupt normal human activities on a regular basis. The noise impacts ... are considered destabilizing if sound levels are sufficiently high that the affected area is essentially unsuitable for normal human activities, or if the behavior or breeding of a threatened or endangered species is affected.

In addition, the U.S. Department of Housing and Urban Development, as set forth in 24 CFR 51.101(a)(8), considers day-night average exterior noise levels 65 dBA and below to be acceptable for residential areas.

On these bases, the staff concludes that the potential impacts of noise resulting from operation of additional nuclear power plants with cooling systems meeting the noise criteria of the PPE (see Appendix I) would be minor at the Grand Gulf ESP site.

5.8.3 Acute Effects of Electromagnetic Fields

EMFs are produced by electrical devices including transmission lines. Two issues related to the health effects of EMFs are addressed in some detail in the GEIS (NRC 1996). Those issues are acute effects (shock hazard) and chronic effects (effects of long-term exposures to EMF).

Acute effects can result from direct contact with transmission lines. Transmission line construction practices minimize public access to the lines. Acute effects can also be caused by induced currents. The 1981 revision of National Electric Safety Code (NESC) added criteria related to construction of transmission lines to minimize potential impacts associated with induced currents. Section 3.7 of SERI's environmental report (2005a) states that the existing transmission and distribution system serving GGNS Unit 1 is adequate for at least an additional 1311 MW(e) generating capacity. Should a new plant with capacity greater than 1311 MW(e) be proposed, SERI would conduct a study to determine the adequacy of the transmission and distribution system existing at that time.

SERI (2005a) has not asserted that the existing transmission and distribution system meets NESC criteria for induced currents or that modifications to the existing system would comply with the relevant local, State, and industry standards including NESC and various American National Standards Institute/Institute of Electrical and Electronics Engineers standards. As a result, the staff cannot come to a conclusion on potential acute impacts of EMFs and this issue is not considered to be resolved.

5.8.4 Chronic Effects of Electromagnetic Fields

Research on the potential for chronic effects from 60-Hz EMFs from energized transmission lines was reviewed in the GEIS (NRC 1996). At that time, research results were not conclusive. The potential for chronic effects from these fields continues to be studied and consensus results are still outstanding. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the DOE. An NIEHS report (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF [extremely low frequency-EMF] exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may

> pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and, therefore, is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the staff to consider the potential impact as significant to the public. However, because conclusive information is not available, this issue is not considered to be resolved.

5.8.5 Occupational Health

In general, human health risks for the operation of new nuclear units are expected to be dominated by occupational injuries (for example, falls, electric shock, asphyxiation) to workers engaged in activities such as maintenance, testing, and facilities modifications. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. Occupational injury and fatality risks are reduced by adherence to NRC and Occupational Safety and Health Administration (OSHA) safety standards, practices, and procedures. Appropriate State and local statutes must also be considered when assessing the occupational hazards and health risks for operation of new nuclear units. The staff assumes adherence to NRC, OSHA, and State safety standards, practices, and procedures for operation of new nuclear units.

Occupational health impacts from thermophilic microorganisms would be the same as those discussed in Section 5.8.1. Health impacts on workers from noise and EMFs would be monitored and controlled in accordance with applicable OSHA regulations.

5.8.6 Summary of Nonradiological Health Impacts

The staff evaluated health impacts on the public and the workers. Health risks to workers are expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts on the public and workers from thermophilic microorganisms and noise generated by operations would be minimal. Based on information provided by SERI and the NRC staff's independent review, the staff concludes that the potential impacts of nonradiological effects resulting from the operation of one or more new nuclear units as defined in the environmental report (SERI 2005a) would be SMALL, and additional mitigation would not be warranted. The staff does not come to conclusions on acute and chronic impacts of EMFs; consequently, these issues are not resolved.

5.9 Radiological Impacts of Normal Operations

This section addresses the radiological impacts of normal operations of the new unit(s), including a discussion of the estimated radiation dose to a member of the public and to the biota inhabiting the area around the new unit(s). Estimated doses to workers at the new unit(s) are also discussed. Radiological impacts were determined using the PPE approach where the bounding direct radiation and liquid and gaseous effluent were used in the evaluation (see discussion in Section 3.2.3).

5.9.1 Exposure Pathways

Using the PPE, SERI's environmental report provided a list of fission and activation products that may be released in gaseous emissions and liquid effluents from the new unit(s) (see SERI 2005a, Tables 3.0-7 and 3.0-8). The impacts from releases and direct radiation were evaluated by considering the probable pathways to individuals, populations, and biota near the additional unit(s). The highest dose from the major exposure pathways were evaluated for a given receptor. The exposure pathways, described in Regulatory Guides 1.109 and 1.111 (NRC 1977a, 1977b), are illustrated in Figures 5-2 and 5-3.

The new unit(s) at the Grand Gulf ESP site would release liquid effluents mixed with the GGNS Unit 1 radiological effluents and cooling tower blowdown to a discharge basin that is then released into the Mississippi River. The liquid pathways considered are ingestion of aquatic food, ingestion of drinking water, exposure to shoreline sediment, and external exposure from the surface of contaminated water or from shoreline sediment and from immersion in contaminated water (SERI 2005a).

The gaseous pathways discussed in the SERI environmental report (SERI 2005a) were external exposure to the airborne radioactivity, external exposure to contaminated ground, inhalation of airborne activity, and ingestion of contaminated agricultural products.

SERI (2005a) stated that the primary contribution to direct radiation exposure from new reactor designs would be from skyshine doses resulting from air scattering of high-energy gamma radiation emitted by decaying nitrogen-16 in the reactor steam lines, turbines, and moisture separators of the operating boiling water reactor. These doses were estimated and determined to be bounded by the doses produced from GGNS Unit 1 (SERI 2005a).

5.9.2 Radiation Doses to Members of the Public

The dose to a maximally exposed individual was calculated from both the liquid and gaseous effluent release pathways (SERI 2005a), and a collective whole body dose was calculated for the population within 80 km (50 mi) of the Grand Gulf ESP site.

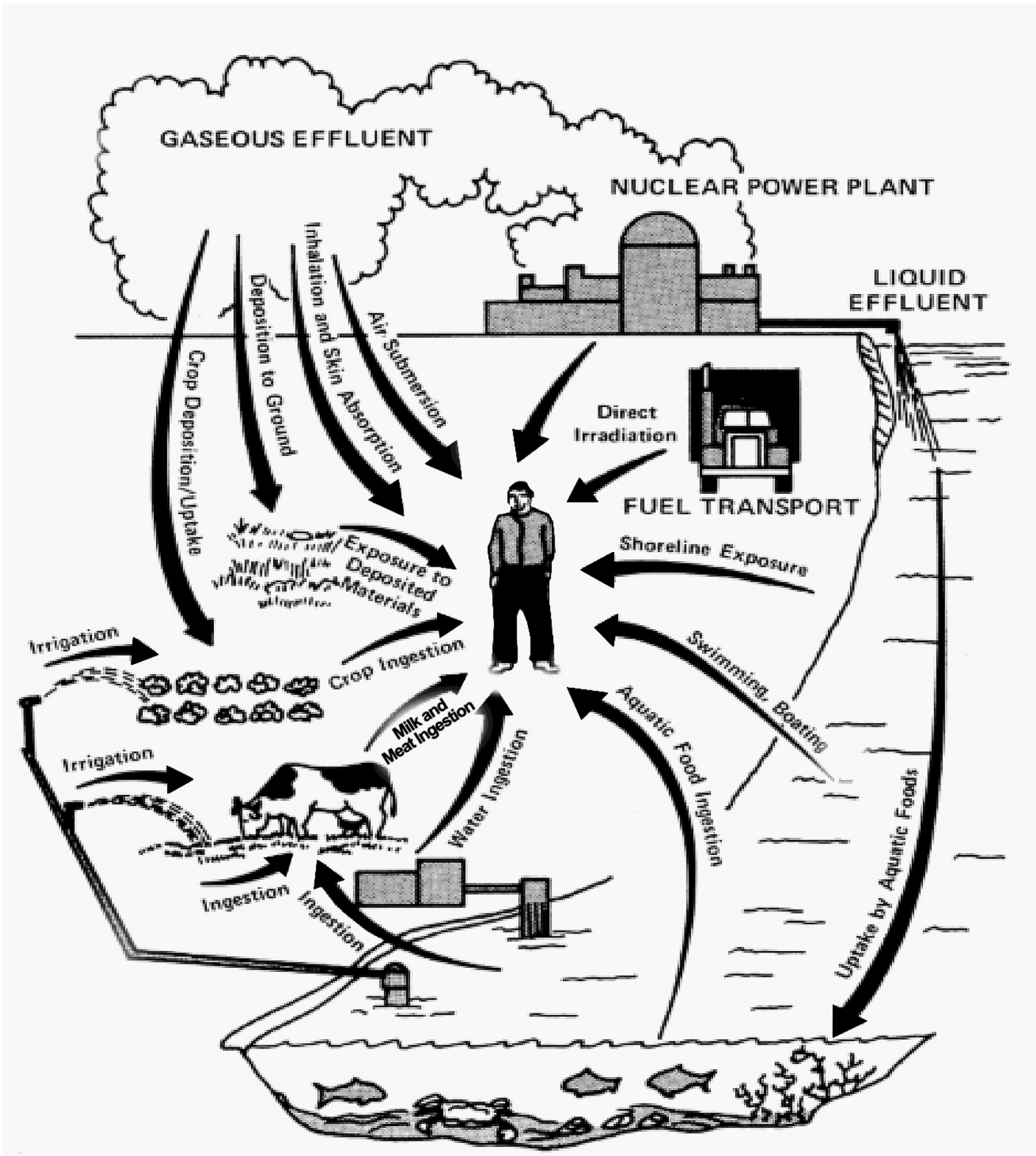

Figure 5-2. Exposure Pathways to Humans

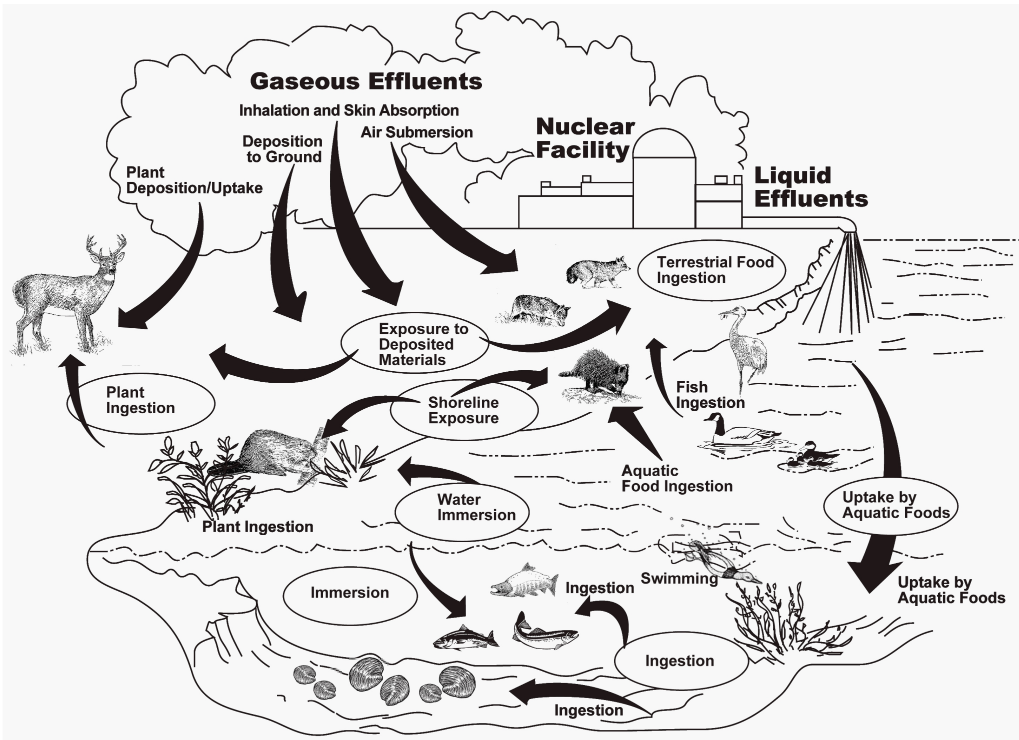

Figure 5-3. Exposure Pathways to Biota Other than Humans

5.9.2.1 Liquid Effluent Pathway

Liquid pathway doses were calculated by SERI using the LADTAP II computer program (Strenge et al. 1986) for the following activities: eating commercially caught fish and invertebrates caught in the river and using the shoreline for recreational purposes. SERI's environmental report (SERI 2005a) shows no use of the Mississippi River for drinking water within 160 km (100 mi) downstream from the Grand Gulf ESP site. Therefore, drinking water was not calculated in the assessment. The liquid effluent releases for one ESP unit used in the estimate of dose to a maximally exposed individual are given in Table 3.0-8 of the SERI environment report (SERI 2005a). These releases were based on a composite release that bounds the potential release from two Advanced Boiling Water Reactor (ABWR) units, two surrogate Advanced Pressurized Water Reactor (AP1000) units, and four Advanced CANDU (CANada Deuterium Uranium) Reactor ACR-700 units. Annual average liquid releases for each of these designs were compared. The most limiting isotopic releases were identified and then included in the composite release (SERI 2005b). This resulted in a slight increase in release rate for those isotopes where the ABWR design was the bounding condition. Other parameters used as input to the LADTAP II program including effluent discharge rate, amount of commercial fish catch, invertebrate harvest, and usage consumption factors are found in Tables 5.4-1 and 5.4-2 of the SERI environment report (SERI 2005a).

Liquid pathway doses to the maximally exposed individuals calculated by SERI are presented in Table 5-5. The maximum annual dose to the total body of an adult was 0.022 mSv (2.2 mrem) for one unit. The maximum annual dose to the bone of a child was 0.041 mSv (4.1 mrem) (SERI 2005a). The staff performed an independent evaluation of liquid pathway doses and found similar results.

Table 5-5. Liquid Pathway Doses for Maximally Exposed Individual at the Grand Gulf Early Site Permit Site from Operation of One New Nuclear Unit

Pathway	Total Body Dose (adult) (mSv/yr)[(a)]	Maximum Organ (bone, child) (mSv/yr)[(a)]
Aquatic Foods	0.022	0.041
Shoreline Use	3.1×10^{-5}	3.6×10^{-5}
Total	**0.022**	**0.041**

(a) Multiply mSv/yr by 100 to obtain mrem/yr.
Source: SERI 2005a. Doses were estimated for one unit.

5.9.2.2 Gaseous Effluent Pathway

Gaseous pathway doses to the maximally exposed individual were calculated by SERI using the GASPAR II computer program (Strenge et al. 1987) at the following locations: the nearest site boundary, nearest vegetable garden, nearest residence, nearest milk cow, and nearest meat cow. The gaseous effluents used in the estimate of dose to the maximally exposed individual are given in Table 3.0-7 of the SERI environmental report (SERI 2005a). These releases, which were estimated for one ESP unit, were based on a composite of the releases for each evaluated design type. The designs include two ABWR units, two surrogate AP1000 units, eight Gas Turbine Modular Helium Reactor (GT-MHR) modules, four ACR-700 units, and six International Reactor Innovative and Secure (IRIS) units. For each radionuclide, the highest release for any proposed design was used for the source term. Other parameters used as input to the GASPAR II program (including milk, meat, and vegetable production rates, meteorological data, population data, and consumption factors) are found in Tables 5.4-3 through 5.4-7 of the SERI environmental report (SERI 2005a).

Gaseous pathway doses to the maximally exposed individuals calculated by SERI are presented in Table 5-6. The dose calculations in Table 5-6 are based on dispersion factors from meteorological data from 2002 to 2003. The staff performed an independent evaluation of gaseous pathway doses and found similar results.

5.9.3 Impacts on Members of the Public

The staff evaluated the impacts on members of the public from the operation of the proposed Grand Gulf ESP facility by identifying the maximally exposed individual and population dose.

5.9.3.1 Maximally Exposed Individual

SERI (2005a) stated that whole body and organ dose estimates to the maximally exposed individual from liquid effluent and gaseous emissions for one unit were within the design objectives of 10 CFR Part 50, Appendix I. The design objectives of 10 CFR Part 50, Appendix I are applicable to each reactor unit. Doses to whole body and maximum organ (bone) from liquid effluent were well within the 0.03 mSv/yr (3 mrem/yr) and 0.1 mSv/yr (10 mrem/yr) 10 CFR Part 50, Appendix I design objectives, respectively. Doses at the exclusion area boundary from gaseous effluents were well within the 10 CFR Part 50, Appendix I design objectives of 0.1 mGy/yr (10 mrad/yr) gamma in air, 0.2 mGy/yr (20 mrad/yr) beta in air, 0.05 mSv/yr (5 mrem/yr) dose to the whole body, and 0.15 mSv/yr (15 mrem/yr) dose to the skin. In addition, dose to the thyroid was within the 0.15 mSv/yr (15 mrem/yr) 10 CFR Part 50, Appendix I design objectives (SERI 2005a). A comparison of dose estimates for one ESP unit to the 10 CFR Part 50, Appendix I design objectives is presented in Table 5-7.

SERI (2005a) stated that doses from liquid and gaseous effluents to the maximally exposed individual at the site boundary from the existing GGNS Unit 1 and the proposed new nuclear unit or units combined were within the regulatory standards of 40 CFR Part 190. The dose standards from 40 CFR Part 190 are 0.25 mSv/yr (25 mrem/yr) to the whole body, 0.75 mSv/yr (75 mrem/yr) to the thyroid, and 0.25 mSv/yr (25 mrem/yr) to any other organ. The combined doses from the existing unit and the ESP units were 0.089 mSv/yr (8.9 mrem/yr) to the whole body, 0.17 mSv/yr (17 mrem/yr) to the thyroid, and 0.21 mSv/yr (21 mrem/yr) to the bone for the maximally exposed member of the public (SERI 2005a, Table 5.4-18). These data are summarized in Table 5-8. Therefore, the combined dose to the maximally exposed individual from GGNS and the new units would be within the 40 CFR Part 190 standards, 10 CFR Part 20 standards, and 10 CFR Part 50, Appendix I design objectives.

5.9.3.2 Population Dose

SERI (2005a) estimated a collective whole body dose within 80 km (50 mi) of each Grand Gulf ESP unit to be 0.032 person-Sv/yr (3.2 person-rem/yr). Collective dose was estimated using the LADTAP II and GASPAR II computer codes (SERI 2005a, Tables 5.4-10 and 5.4-13, respectively). Collective dose from the liquid effluent pathways was calculated for the aquatic food pathway, but not drinking water since the Mississippi River is not used for drinking water within 160 km (100 mi). The staff independently evaluated the population doses and found

Table 5-6. Gaseous Pathway Doses for Maximally Exposed Individual from Operation of One New Nuclear Unit[(a)]

		Dose Rate (mSv/yr)[(b)]		
Location	**Pathway**	**Total Body**	**Skin**[(c)]	**Thyroid**
Nearest Residence[(d)] (NNE, 1.02 km (0.64 mi))	Plume Exposure	0.0063	0.021	0.0063
	Inhalation			
	Adult	0.0017		0.0069
	Teen	0.0017		0.0085
	Child	0.0015		0.0099
	Infant	0.00088		0.0086
Nearest Garden[(d)] (ENE, 1.01 km (0.63 mi))	Vegetable Consumption			
	Adult	0.0039		0.029
	Teen	0.0049		0.036
	Child	0.009		0.067
Nearest Site Boundary[(e)] (N, 0.93 km (0.58 mi))	Plume Exposure	0.012	0.039	0.012
	Inhalation			
	Adult	0.0032		0.013
	Teen	0.0032		0.016
	Child	0.0028		0.018
Nearest Milk Cow[(d)] (SSW, 16 km (10 mi))	Cow Milk			
	Adult	0.000056		0.00055
	Teen	0.000083		0.00086
	Child	0.00016		0.0017
	Infant	0.00029		0.0041
Nearest Meat Cow[(d)] (S, 6.4 km (4.0 mi))	Meat Consumption			
	Adult	0.000065		0.00014
	Teen	0.000047		0.0001
	Child	0.000076		0.00016

(a) Data provided in SERI 2005a was for one unit.
(b) mSv = millisievert; multiply mSv/yr by 100 to obtain mrem/yr.
(c) Skin dose is only applicable to plume exposure.
(d) "Nearest" refers to the location at which the highest radiation dose to an individual from the applicable pathways has been estimated.
(e) "Nearest" refers to that site boundary location at which the highest radiation doses from gaseous emissions have been estimated to occur.

Table 5-7. Comparison of Maximum Individual Dose to 10 CFR Part 50, Appendix I Design Objective per Unit

Type of Dose	Design Objective[(a)]	Point of Evaluation	Calculated Dose[(a)]
Gaseous Effluents			
Gamma air dose	0.1 mGy/yr (10 mrad/yr)	Exclusion Area Boundary	0.018 mGy/yr (1.8 mrad/yr)
Beta air dose	0.2 mGy/yr (20 mrad/yr)	Exclusion Area Boundary	0.035 mGy/yr (3.5 mrad/yr)
Total body dose	0.05 mSv/yr (5 mrem/yr)	Exclusion Area Boundary	0.016 mSv/yr (1.6 mrem/yr)
Skin dose	0.15 mSv/yr (15 mrem/yr)	Exclusion Area Boundary	0.044 mSv/yr (4.4 mrem/yr)
Radioiodines and Particulates			
Vegetable Consumption	0.15 mSv/yr (15 mrem/yr)	Nearest Garden	0.067 mSv/yr (6.7 mrem/yr) (thyroid, child)

(a) mGy = milligray, mrad = millirad, mSv = millisievert, mrem = millirem
Sources: 10 CFR Part 50, Appendix I; SERI 2005a

Table 5-8. Comparison of Maximally Exposed Individual Dose Estimates from Liquid and Gaseous Effluents from Operation of GGNS Unit 1 and Two New Nuclear Units to 40 CFR Part 190 Standards

Dose	SERI Estimate[(a)(b)]	40 CFR Part 190 Standards[(b)]
Whole body dose equivalent	0.089 mSv/yr	0.25 mSv/yr
Thyroid dose	0.17 mSv/yr	0.75 mSv/yr
Dose to organ (bone)	0.21 mSv/yr	0.25 mSv/yr

(a) Doses were estimated for GGNS Unit 1 and two ESP units (SERI 2005a, Table 5.4-18).
(b) mSv = millisievert; multiply mSv/yr by 100 to obtain mrem/yr.

similar results. For comparative purposes, the estimated collective dose from natural background radiation to the population within 80 km (50 mi) of the proposed Grand Gulf ESP site is 1020 person-Sv/yr (102,000 person-rem/yr).

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses below about 100 mSv (10,000 mrem) and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), BEIR VII report, supports the linear, no threshold dose response. Simply put, this theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Based on this model, the staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem)) from International Commission on Radiological Protection (ICRP) Publication 60 (ICRP 1991). This coefficient was multiplied by the estimated collective whole body population dose of 0.032 person-Sv/yr (3.2 person-rem/yr) to calculate that the population living within 80 km (50 mi) of the Grand Gulf ESP site would incur a total of approximately 0.002 fatal cancers, nonfatal cancers, and severe hereditary effects annually. The risks from the cumulative radiation exposure from GGNS and the proposed ESP units would be only slightly higher. This risk is very small compared to the estimated 75 fatal cancers, nonfatal cancers, and severe hereditary effects that the same population would incur annually from exposure to natural sources of radiation.

In addition, at the request of the U.S. Congress, the National Cancer Institute conducted a study and published "Cancer in Populations Living Near Nuclear Facilities" in 1990. This report included an evaluation of health statistics around all nuclear power plants, as well as several other nuclear fuel cycle facilities, in operation in the United States in 1981 and found "no evidence that an excess occurrence of cancer has resulted from living near nuclear facilities" (NCI 1990).

5.9.3.3 Summary of Radiological Impacts on Members of the Public

The NRC staff evaluated the health impacts from routine gaseous and liquid radiological effluent releases from new nuclear units at the Grand Gulf ESP site. Based on the information provided by SERI and the NRC staff's independent review, the NRC staff concludes there would be no observable health impacts on the public from normal operation of new nuclear units, and the health impacts would be SMALL.

5.9.4 Occupational Doses to Workers

On the basis of information contained in NUREG-0713 (NRC 2002b), the average annual collective dose per operating reactor was 1.72 person-Sv/yr (172 person-rem yr) for the time period from 1992 to 2001. Limited information is available on occupational dose estimates from the advanced reactor designs, and SERI did not provide such information. However, Dominion Energy, Inc., in a study regarding potential sites for new nuclear power plants, reported annual occupational dose estimates of 1.5 person-Sv (150 person-rem) for the AP1000 reactor, IRIS, and GT-MHR designs (Dominion and Bechtel 2002). The estimated occupational doses for the advanced reactor designs were slightly less than annual occupational doses for current light water reactors (LWRs). The staff reviewed this information and concluded (1) that the information was generically applicable to SERI's application and (2) that the annual dose estimates are reasonable. Moreover, the environmental impact from this occupational dose is considered small because the dose to any individual worker is maintained within the limits of 10 CFR Part 20 (0.05 Sv/yr (5 rem/yr)).

5.9.5 Impacts on Biota Other than Members of the Public

SERI (2005a) estimated doses to surrogate species (fish, invertebrates, algae, muskrat, raccoon, heron, and duck). Fish, invertebrates, and algae are referred to as aquatic species. Muskrats, racoons, herons, and ducks are referred to as terrestrial species. Important biota species for the Grand Gulf ESP site and the corresponding surrogate species are bald eagle and woodstork (heron), pallid sturgeon (fish), and fat pocketbook mussel (invertebrate). Surrogate species are well defined and provide an acceptable method for judging doses to the biota (SERI 2005a). Exposure pathways considered in evaluating dose to the biota are discussed in Section 5.9.1 and shown in Figure 5-3.

5.9.5.1 Liquid Effluent Pathways

SERI (2005a) used the LADTAP II computer code to calculate doses to the biota from liquid effluent pathways. The following exposure pathways (illustrated in Figure 5-3) were evaluated for the different surrogate biota:

- Fish and invertebrates – internal exposure from bioaccumulation of radionuclides and external exposure from swimming and shoreline activities

- Algae – internal exposure from bioaccumulation of radionuclides and external exposure from immersion in water

- Muskrat and duck – internal exposure from ingestion of aquatic plants and external exposure from swimming and shoreline activities

- Raccoon – internal exposure from ingestion of invertebrates and external exposure from shoreline activities

- Heron – internal exposure from ingestion of fish and external exposure from swimming and shoreline activities.

Input parameters used in the dose calculation included food consumption rates, body masses, and effective body radii. These parameters were taken from NUREG/CR-4013 (Strenge et al. 1986). These parameters are shown in Tables 5.4-14 and 5.4-15 of the SERI environmental report (SERI 2005a). The LADTAP II program has an adjustment factor because the biota would be closer to any potential shoreline contamination than humans.

5.9.5.2 Gaseous Effluent Pathways

SERI used the doses calculated for the maximally exposed individual from the gaseous effluent pathways (described earlier in this section) as a basis for the doses to the biota. External doses from ground deposition were increased to account for the terrestrial organisms being closer to the ground (SERI 2005a).

5.9.5.3 Impacts of Estimated Biota Doses

Table 5-9 compares the estimated whole body dose to the biota from the liquid and gaseous effluent pathways calculated by SERI (2005a) from one proposed new unit at the Grand Gulf ESP site to the regulatory standard for humans in 40 CFR Part 190. The biota doses for all surrogate species exceed the regulatory standard in 40 CFR Part 190 of 0.25 mSv/yr (25 mrem/yr) to the total body. This assumes mrem and mrad are approximately equivalent. The staff performed an independent evaluation of biota doses and found similar results.

The ICRP (1977, 1991) states that if man is adequately protected, then other living things are also likely to be sufficiently protected. The International Atomic Energy Agency (IAEA 1992) and the National Council on Radiation Protection and Measurements (NCRP 1991) reported that a chronic dose rate of no greater than 10 mGy/day (1 rad/day) to the maximally exposed individual in a population of aquatic organisms would ensure protection for the population. IAEA (1992) also concluded that chronic dose rates of 1 mG/day (0.1 rad/day) or less do not appear to cause observable changes in terrestrial animal populations. Table 5-9 compares the estimated whole body dose to the biota for the proposed unit or units to the IAEA chronic dose rate values for aquatic organisms and terrestrial animals. The cumulative effects of current operating units and proposed unit or units would result in dose rates significantly less than the NCRP and IAEA studies.

The staff performed an independent evaluation of doses to biota and found similar results.

Table 5-9. Comparison of Biota Dose Estimates from Liquid and Gaseous Effluents from Operation of New Nuclear Units to 40 CFR Part 190 Standards and Relevant Guidelines for Biota Protection

Biota	Dose from Liquid Effluents/Unit (mGy/yr)[a]	Dose from Gaseous Effluents/Unit (mGy/yr)[a]	Total Dose/Unit (mGy/yr)[a]	Total Dose for Two Units (mGy/yr)[a]	40 CFR Part 190 Total Body Dose Limit (mSv/yr)[b]	IAEA/NCRP Guideline for Protection of Biota Populations (mGy/yr)[a]
Fish	0.25	0	0.25	0.51	0.25	3650
Invertebrate	1.65	0	1.65	3.31	0.25	3650
Algae	1.48	0	1.48	2.96	0.25	3650
Muskrat	0.81	0.022	0.83	1.67	0.25	365
Raccoon	0.19	0.02	0.21	0.42	0.25	365
Heron	1.93	0.018	1.95	3.91	0.25	365
Duck	0.81	0.023	0.83	1.67	0.25	365

(a) mGy = milligray; multiply mGy/yr by 100 to obtain mrad/yr.
(b) mSv = millisievert; multiply mSv/yr by 100 to obtain mrem/yr.
IAEA = International Atomic Energy Agency
NCRP = National Council on Radiation Protection and Measurements
Sources: SERI 2005a, Tables 5.4-16 and 5.4-17; IAEA 1992; NCRP 1991

In conclusion, the staff reviewed the available information related to the radiological impact on biota from the routine operation of the proposed Grand Gulf ESP unit(s) and concluded that the impact would be SMALL, and mitigation would not be warranted.

5.9.6 Radiological Monitoring

A radiological environmental monitoring program (REMP) (10 CFR 50.34a(a); 10 CFR 50.36a(a); SEC IV, B.2 of Appendix I in 10 CFR Part 50) has been performed around the Grand Gulf site since 1978. The REMP includes monitoring of the airborne exposure pathway, direct exposure pathway, water exposure pathway, aquatic exposure pathway with control and indicator locations within a 29 km (18 mi) radius of the site. Milk is sampled when there is commercial milk production within 8 km (5 mi) of the site. The pre-operational REMP sampled various media in the environment to determine a baseline from which to observe the magnitude and fluctuation of radioactivity in the environment once the unit began operation (Entergy 2003b). The pre-operational program included collection and analysis of samples of air particulates, precipitation, milk, crops, soil, well water, surface water, fish, and silt as well as measurement of ambient gamma radiation. After operation of GGNS Unit 1 plant began in 1985, the monitoring program continued to assess the radiological impacts on workers, the public, and the environment. Radiological releases are summarized in the two annual reports: the *Annual Radiological Environmental Operating Report* (Entergy 2003b) and *Annual Radioactive Effluent Release Report* (Entergy 2003a). The limits for all radiological releases are specified in the *Grand Gulf Offsite Dose Calculation Manual* (Entergy 2004). No additional monitoring program has been established for the new unit(s). The staff reviewed the documentation for the REMP, the Grand Gulf Offsite Dose Calculation Manual, and recent monitoring reports from SERI and the state of Mississippi (MDH 2004) and determined that the current operational monitoring program is adequate to establish the radiological baseline for comparison with the expected impacts on the environment related to the construction and operation of proposed new unit(s) at the Grand Gulf ESP site.

5.10 Environmental Impacts of Postulated Accidents

The staff considered the radiological consequences on the human environment of potential accidents at one or more new nuclear units at the Grand Gulf ESP site. Consequence estimates are based on the General Electric ABWR standard reactor design, which has been certified by the NRC (10 CFR Part 52, Appendix A), and the surrogate Westinghouse AP1000. The term “accident,” as used in this section, refers to any off-normal event not addressed in Section 5.9 that results in the release of radioactive materials into the environment. The focus of this review is on events that could lead to releases substantially in excess of permissible limits for normal operations. Normal release limits are specified in 10 CFR Part 20, Appendix B, Table 2.

Numerous features combine to reduce the risk associated with accidents at nuclear power plants. Safety features in the design, construction, and operation of the plants, which compose the first line of defense, are intended to prevent the release of radioactive materials from the plant. The design objectives and the measures for keeping levels of radioactive materials in effluents to unrestricted areas as low as is reasonably achievable (ALARA) are specified in 10 CFR Part 50, Appendix I. There are additional measures that are designed to mitigate the consequences of failures in the first line of defense. These include the NRC’s reactor site criteria in 10 CFR Part 100, which require the site to have certain characteristics that reduce the risk to the public and the potential impact of an accident, and emergency preparedness plans and protective action measures for the site and environs as set forth in 10 CFR 50.47; 10 CFR Part 50, Appendix E; and NUREG-0654/FEMA-REP-1 (NRC and FEMA 1980). All of these safety features, measures, and plans make up the defense-in-depth philosophy to protect the health and safety of the public and the environment.

This section discusses (1) the types of radioactive materials, (2) the paths to the environment, (3) the relationship between radiation dose and health effects, and (4) the environmental impacts of postulated reactor accidents, both design basis accidents (DBAs) and severe accidents. The environmental impacts of postulated accidents during transportation of spent fuel are discussed in Chapter 6.

The potential for dispersion of radioactive materials in the environment depends on the mechanical forces that physically transport the materials and on the physical and chemical forms of the materials. Radioactive material exists in a variety of physical and chemical forms. The majority of the material in the fuel is in the form of nonvolatile solids. However, there is a significant amount of material that is in the form of volatile solids or gases. Gaseous radioactive materials include the chemically inert noble gases krypton and xenon, which have a high potential for release. Radioactive forms of iodine, which are created in substantial quantities in the fuel by fission, are volatile. Other radioactive materials formed during the routine operation of a nuclear power plant have lower volatilities and, therefore, have lower tendencies to escape from the fuel than the noble gases and iodines.

Radiation exposure to individuals is determined by their proximity to radioactive material, the duration of their exposure, and the extent to which they are shielded from the radiation. Pathways that lead to radiation exposure include external radiation from radioactive material in the air, on the ground, and in the water; the inhalation of radioactive material; and ingestion of food or water containing material initially deposited on the ground and in water.

The risks of health effects from radiation exposure below 0.1 Sv (10 rem) are either too small to be observed or are non-existent (HPS 2004). After exposure to higher levels of radiation, incidences of cancer in the exposed general population may begin to develop after a lapse of 2 to 15 years (latent period) and then level off over a period of about 30 years (plateau period). In the case of radiation exposure of fetuses, cancer may begin to develop as early as at birth (no latent period) to the age of 10.

Physiological effects are clinically detectable should individuals receive radiation exposure resulting in a dose greater than about 0.25 Sv (25 rem) over a short period of time (hours). Doses of about 2.5 to 5.0 Sv (250 to 500 rem) received over a relatively short period (hours to a few days) can be expected to cause some fatalities.

5.10.1 Design Basis Accidents

SERI evaluated the potential consequences of postulated accidents to demonstrate that new unit(s) could be constructed and operated at the Grand Gulf ESP site without undue risk to the health and safety of the public. These evaluations use a set of surrogate DBAs that are representative for the range of reactor designs being considered for the ESP site and site-specific meteorological data. The set of accidents covers events that range from relatively high probability of occurrence with relatively low consequences to relatively low probability with high consequences.

The DBA review focuses on two light water reactor designs: the ABWR and the surrogate AP1000. The bases for analyses of postulated accidents for these designs are well established because they have been considered as part of the NRC's advanced reactor design certification process. Accidents for the other reactor designs listed in SERI's ESP are not as well defined as those for the ABWR and the surrogate AP1000; acceptable assumptions and methodologies for the evaluation of postulated accidents have not been fully established. Consequently, design basis accidents for reactor designs other than light-water designs are not resolved. Because the source terms for accident analyses are generally proportional to the power level, for the purposes of this environmental impact evaluation, the potential consequences of accidents for the other reactor designs are expected to be bounded by those for the ABWR and surrogate AP1000 designs. For example, preliminary information on source terms for the IRIS and ACR-700 reactor designs indicates that the source terms for the surrogate AP1000 loss-of-coolant accident (LOCA) would bound the worst-case accident release for these advanced reactor designs. Similarly, the ABWR source terms are expected to bound the source terms for the Economic Simplified Boiling Water Reactor (ESBWR) design. The advanced gas reactor designs (GT-MHR and Pebble Bed Modular Reactor) postulate relatively small releases to the environment compared to water reactor technologies (SERI 2005a).

Should an application for a CP or COL that references an ESP at the Grand Gulf ESP site reference one of the designs other than an ABWR or surrogate AP1000, the applicant would be required to show – and the staff would verify – that the radiological consequences of DBAs for the proposed reactor(s) are bounded by the consequences of DBAs evaluated in this EIS.

Potential consequences of DBAs are evaluated following procedures outlined in regulatory guides and standard review plans. The potential consequences of accidental releases depend on the specific radionuclides released, the amount of each radionuclide released, and meteorological conditions. The source terms for the ABWR design are based on TID-14844 (AEC 1962) guidance, and guidance on methods for evaluating potential accidents for the ABWR are set forth in NUREG-0800 (NRC 1987), Regulatory Guide 1.3 (NRC 1974a), and Regulatory Guide 1.25 (NRC 1974b). The source terms for the surrogate AP1000 reactor and methods for evaluating potential accidents are based on guidance in Regulatory Guide 1.183 (NRC 2000b).

For environmental reviews, consequences are evaluated assuming realistic meteorological conditions. Meteorological conditions are represented in these consequence analyses by an atmospheric dispersion factor, which is also referred to as X/Q. Acceptable methods of calculating X/Q for DBAs from meteorological data are set forth in Regulatory Guide 1.145 (NRC 1983).

SERI provided the staff with meteorological data for the Grand Gulf ESP site for 2002 and 2003 (SERI 2004b). These data have been reviewed by the staff and found to be representative of the meteorological conditions at the site. The meteorological instrumentation and its maintenance are consistent with staff guidance, and the data quality is consistent with standards set forth in that guidance. Therefore, the data are considered acceptable for use in evaluation of the consequences of DBAs. The staff also reviewed SERI's procedures for calculating site-specific X/Qs and found them to be consistent with staff guidance.

Table 5-10 lists X/Q values pertinent to the evaluation of the suitability of the Grand Gulf ESP site. The first column lists the time periods and boundaries for which X/Q values and dose estimates are needed. For the EAB, the postulated DBA dose and its atmospheric dispersion factor are calculated for a short-term, i.e., 2 hours, and for the low population zone (LPZ), they are calculated for the course of the accident, i.e., 30 days (720 hours) composed of four time periods. The second column lists the X/Q values calculated by SERI using the site meteorological information discussed in environmental report Section 2.7.5 (SERI 2005a) and the EAB and LPZ distances from Section 2.7.6 of the environmental report. No credit was taken for building wake. These X/Q values are expected to be exceeded no more than five percent of the time.

Table 5-10. Atmospheric Dispersion Factors (X/Q, s/m^3) for the Grand Gulf Early Site Permit Site Design Basis Accident Calculations

Time Period[a] and Boundary	Site	
	Adverse	Typical
0 to 2 hr, Exclusion Area Boundary	5.95×10^{-4}	8.82×10^{-5}
0 to 8 hr, Low Population Zone	8.83×10^{-5}	2.83×10^{-5}
8 to 24 hr, Low Population Zone	6.16×10^{-5}	2.21×10^{-5}
1 to 4 day, Low Population Zone	2.82×10^{-5}	1.29×10^{-5}
4 to 30 day, Low Population Zone	9.15×10^{-6}	5.95×10^{-6}

(a) Times are relative to the beginning of the release to the environment.

In its independent assessment, the staff evaluated SERI's process for deriving the site X/Q values from site-specific information. The staff determined the process is consistent with NRC guidance (NRC 1983), but the X/Q values are not acceptable for use in environmental reviews because they are for adverse meteorological conditions rather than typical conditions.

Using information provided by SERI and the procedure described in Regulatory Guide 1.145, the staff estimated site X/Q values for typical meteorological conditions using the EAB and LPZ distances given in the ESP application. The staff's estimates of X/Q values for typical meteorological conditions are listed in the last column of Table 5-10. These values indicate the atmospheric dilution capability in the vicinity of the site. Small X/Q values are associated with greater dilution capability. Thus, if a design X/Q value for a specific reactor design identified as part of the CP or COL were greater than or equal to the site-specific X/Q value, then atmospheric dispersion at the site is sufficient such that the doses predicted for postulated DBAs for the design would likely be below regulatory limits.

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The staff concludes that the atmospheric dispersion characteristics of the Grand Gulf ESP site are acceptable with respect to the potential environmental consequences of postulated DBAs | for reactor designs with design X/Q values falling within the bounds set by the staff's site X/Q | values. At the CP or COL stage, the staff would need to verify that the X/Q values for reactor | designs proposed at the CP/COL stage are bounded by the site X/Q values used in this | analysis. Additional evaluation will be needed if reactor design X/Q values do not meet this | criterion.

Tables 5-11 and 5-12 list the set of surrogate DBAs considered by SERI and present the staff's estimate of the environmental consequences of each DBA in terms of total effective dose equivalent (TEDE). TEDE is the sum of the committed effective dose equivalent (CEDE) from inhalation and the deep dose equivalent from external exposure. Dose conversion factors from Federal Guidance Report 11 (Eckerman et al. 1988) were used to calculate the CEDE. Similarly, dose conversion factors from Federal Guidance Report 12 (Eckerman and Ryman 1993) were used to calculate the deep dose equivalent.

| TEDE values were estimated for the ABWR by multiplying the thyroid dose by a factor of 0.03 (the organ weighting factor for the thyroid in the TEDE methodology) and adding the product to the whole body dose. The review criteria used in the staff's safety review of DBA doses are included in Tables 5-11 and 5-12 to illustrate how small the calculated environmental consequences (TEDE doses) are.

In addition to the evaluation of the DBAs for the ABWR and surrogate AP1000 designs described above, SERI evaluated the consequences of a postulated LOCA for the ACR-700 | reactor design. The staff's estimate of the 0 to 2 hr TEDE at the EAB is 8.8×10^{-3} Sv (0.88 rem), and the estimate for TEDE for the LPZ is 1.7×10^{-2} Sv (1.7 rem). These TEDE values for the ACR-700 are well below the review criteria used in the staff's safety review of | DBA doses (0.25 Sv (25 rem) for EAB and LPZ). These comparisons are included to illustrate how small the calculated environmental consequences (TEDE doses) are.

| In all cases, the calculated TEDE values are small – considerably smaller that the TEDE doses used as safety review criteria. The environmental impacts of DBAs have not been explicitly | evaluated for gas-cooled reactors because necessary design information is lacking. The staff | expects, however, that releases to the environment under accident conditions would be small

| for such designs. Should an applicant for a CP or COL reference an LWR design, the staff | would need to verify that the doses for postulated DBAs for the actual reactor design remain bounded by the environmental impacts from the surrogate reactor designs considered in this | EIS. Because impacts of DBAs for gas-cooled designs are not resolved at the ESP stage, the | applicant would need to provide an evaluation of the impacts of DBAs.

Table 5-11. Design Basis Accident Doses for an Advanced Boiling Water Reactor

Accident	Standard Review Plan Section[b]	TEDE in Sv[a] EAB	LPZ	Review Criterion
Main Steam Line Break	15.6.4			
Pre-Existing Iodine Spike		1.4×10^{-3}	4.8×10^{-4}	2.5×10^{-1}(c)
Accident-Initiated Iodine Spike		7.0×10^{-5}	2.4×10^{-5}	2.5×10^{-2}(d)
Loss-of-Coolant Accident	15.6.5	5.9×10^{-3}	5.4×10^{-2}	2.5×10^{-1}(c)
Failure of Small Lines Carrying Primary Coolant Outside Containment	15.6.2	1.2×10^{-4}	4.2×10^{-5}	2.5×10^{-2}(d)
Fuel Handling	15.7.4	9.8×10^{-4}	3.3×10^{-4}	6.25×10^{-2}(d)

(a) To convert Sv to rem, multiply by 100.
(b) NUREG-0800 (NRC 1987)
(c) 10 CFR 50.34(a)(1); 10 CFR 100.11; 10 CFR 100.21
(d) Standard Review Plan criterion
EAB = exclusion area boundary
LPZ = low population zone
TEDE = total effective dose equivalent

Although SERI chose to use the PPE approach in its ESP application, it based its evaluation of the environmental impact of DBAs on characteristics of the ABWR and the surrogate AP1000 reactor designs with the explicit assumption that the impact would bound the impact of other advanced LWR designs (SERI 2005a). The NRC staff reviewed the analysis in the environmental report, which is based on analyses performed for design certification of these reactor designs and found it appropriate for safety analyses, but overly conservative for environmental reviews. Therefore, the staff adjusted the results of the SERI analysis to reflect typical meteorological conditions. The results of both the SERI and the staff analyses indicate that the environmental risks associated with DBAs, should an advanced LWR be located at the Grand Gulf ESP site, would be small compared to the TEDE doses used as safety review criteria. On this basis, the staff concludes that the consequences of DBAs at the Grand Gulf ESP site are of SMALL significance for advanced LWRs. The environmental impacts of DBAs have not been explicitly evaluated for gas-cooled reactors and are, therefore, unresolved. These impacts would need to be evaluated at the CP or COL stage if such a design were selected. For the evaluation in this EIS to bound the reactor design selected at the CP or COL stage, an applicant referencing the Grand Gulf ESP would need to demonstrate that the environmental impacts of a DBA at the proposed Grand Gulf ESP site remain bounded by the environmental impacts for the surrogate designs considered in this EIS.

Table 5-12. Design Basis Accident Doses for a Surrogate AP1000 Reactor

Accident	Standard Review Plan Section[b]	TEDE in Sv[a] EAB	LPZ	Review Criterion
Main Steam Line Break	15.1.5			
Pre-Existing Iodine Spike		9.6×10^{-4}	1.0×10^{-3}	2.5×10^{-1}(c)
Accident-Initiated Iodine Spike		1.1×10^{-3}	3.8×10^{-3}	2.5×10^{-2}(d)
Steam Generator Rupture	15.6.3			
Pre-Existing Iodine Spike		4.1×10^{-3}	7.5×10^{-4}	2.5×10^{-1}(c)
Accident-Initiated Iodine Spike		2.1×10^{-3}	5.3×10^{-4}	2.5×10^{-2}(d)
Loss-of-Coolant Accident	15.6.5	3.4×10^{-2}	2.2×10^{-2}	2.5×10^{-1}(c)
Rod Ejection	15.4.8	4.1×10^{-3}	3.7×10^{-3}	6.25×10^{-2}(d)
Reactor Coolant Pump Rotor Seizure (Locked Rotor)	15.3.3	3.5×10^{-3}	1.3×10^{-3}	2.5×10^{-2}(d)
Failure of Small Lines Carrying Primary Coolant Outside Containment	15.6.2	1.8×10^{-3}	6.4×10^{-4}	2.5×10^{-2}(d)
Fuel Handling	15.7.4	3.3×10^{-3}	1.3×10^{-3}	6.25×10^{-2}(d)

(a) To convert Sv to rem, multiply by 100.
(b) NUREG-0800 (NRC 1987)
(c) 10 CFR 50.34(a)(1); 10 CFR 100.21
(d) Standard Review Plan criterion
EAB = exclusion area boundary
LPZ = low population zone
TEDE = total effective dose equivalent

5.10.2 Severe Accidents

In its environmental report, SERI (2005a) bases its evaluation of the potential environmental consequences of severe accidents on the evaluation of potential consequences of severe accidents for current generation reactors presented in the GEIS (NRC 1996). Three pathways were considered: the atmospheric pathway in which radioactive material is released to the air, the surface water pathway in which airborne radioactive material falls out on open bodies of water, and the groundwater pathway in which groundwater is contaminated by a basemat melt-through with subsequent contamination of surface water by the groundwater.

In response to an NRC request for additional information dated May 19, 2004 (NRC 2004a), SERI performed a site-specific analysis of the potential environmental consequences of postulated severe accidents at the Grand Gulf ESP site. Because the PPE does not include source terms for severe accidents, SERI used the source terms for the ABWR and surrogate AP1000 reactors. SERI used the MACCS2 computer code (Chanin et al. 1990; Jow et al.

1990) for the analysis. Input to the MACCS2 computer code and summary results of the analysis were submitted to the NRC in a letter dated August 10, 2004 (SERI 2004g).

The MACCS computer code was developed to evaluate the potential offsite consequences of severe accidents for the sites covered by NUREG-1150 (NRC 1990). MACCS2 (Chanin and Young 1997) is the current version of MACCS. The MACCS and MACCS2 codes evaluate the consequences of atmospheric releases of radioactive material following a severe accident. The pathways modeled include external exposure to the passing plume, exposure to material deposited on the ground and skin, inhalation of material in the passing plume and resuspended from the ground, and ingestion of contaminated food and surface water. The primary enhancements in MACCS2 are that MACCS2 has (1) a more flexible emergency response model, (2) an expanded library of radionuclides, and (3) a semidynamic food-chain model (Chanin and Young 1997).

Three types of severe accident consequences were assessed: (1) human health, (2) economic costs, and (3) land area affected by contamination. Human-health effects are expressed in terms of the number of cancers that might be expected if a severe accident were to occur. These effects are directly related to the cumulative radiation dose received by the general population. MACCS2 estimates both early cancer fatalities and latent fatalities. Early fatalities are related to high doses or dose rates and can be expected to occur within a year of exposure (Jow et al. 1990). Latent fatalities are related to exposure of a large number of people to low doses and dose rates and can be expected to occur after a latent period of several (2 to 15) years. Population health-risk estimates (latent and early cancers) are based on the population distribution within an 80-km (50-mi) radius of the plant, although early fatalities would be expected only in the population near the site. MACCS2 also calculates average individual health risks (early and latent fatalities) for individuals near the site. The risk of an early cancer fatality is calculated for individuals within 1.6 km (1 mi) and the risk of a latent cancer fatality is calculated for individuals within 16 km (10 mi). Economic costs of a severe accident include the costs associated with short-term relocation of people, decontamination of property and equipment, interdiction of food supplies, land and equipment use, and condemnation of property. The affected land area is a measure of the areal extent of the residual contamination following a severe accident.

Risk is the product of the frequency of an accident and the consequences of the accident. For example, the probability of a severe accident without loss of containment for an ABWR is estimated to be 1.34×10^{-7} per reactor year (Ryr^{-1}); and the cumulative population dose associated with a severe accident without loss of containment at the Grand Gulf ESP site is calculated to be 7.11×10^{1} person-Sv (7.11×10^{3} person-rem). The population dose risk for this class of accidents is the product of 1.34×10^{-7} Ryr^{-1} and 7.11×10^{1} person-Sv, or 9.53×10^{-6} person-Sv Ryr^{-1} (9.53×10^{-4} person-rem Ryr^{-1}). The following sections discuss the estimated risks associated with each pathway.

The risk presented in the tables that follow is risk per year of reactor operation. SERI has indicated the Grand Gulf ESP site could support reactors producing a total of 8600 MW(t). Based on this limit, the site could hold two ABWR or AP1000 reactors. The consequences of a severe accident would be the same regardless of whether one or two reactors were built. However, if two reactors were built, the risk would apply to each reactor, and the total risk for new reactors at the site would be twice the risk for a single reactor. Even if the risk values were doubled, the risks would still be significantly smaller than the risks associated with current-generation reactors.

5.10.2.1 Air Pathway

The MACCS2 code directly estimates consequences associated with releases to the air pathway. For the purposes of this analysis, the power levels of the ABWR and surrogate AP1000 reactors were scaled to 4300 MW(t) and 3415 MW(t), respectively (SERI 2004g). The results of the MACCS2 runs are presented in Tables 5-13 and 5-14. The core damage frequencies given in these tables are for internally initiated accident sequences while the plant is at power. Internally initiated accident sequences include sequences initiated by equipment failures, loss of offsite power, and human error. Based on insights from the review of the advanced LWR probabilistic risk assessments, the core damage frequencies for externally initiated events and during shutdown would be comparable to or lower than those for internally initiated events.

Tables 5-13 and 5-14 show that the probability weighted consequences, i.e., the risks, of severe accidents for an ABWR or a surrogate AP1000 reactor located on the Grand Gulf ESP site are small for all risk categories considered. For perspective, Tables 5-15 and 5-16 compare the health risks from severe accidents for the ABWR or surrogate AP1000 reactors at the Grand Gulf ESP site with the risks for current-generation reactors at various sites.

In Table 5-15, the health risks estimated for the ABWR and surrogate AP1000 reactors at the Grand Gulf ESP site are compared with health risk estimates for the five reactors considered in NUREG-1150 (NRC 1990). Although risks associated with both internally and externally initiated events were considered for the Peach Bottom and Surry reactors in NUREG-1150, only risks associated with internally initiated events are presented in Table 5-16. The health risks shown for the ABWR and surrogate AP1000 reactors at the Grand Gulf ESP site are significantly lower than the risks associated with current-generation operating reactors presented in NUREG-1150 (NRC 1990).

In addition, the last two columns of Table 5-15 provide average individual fatality risk estimates for comparison to the Commission's safety goals. The Commission has set safety goals for

Table 5-13. Mean Environmental Risk from Advanced Boiling Water Reactor Severe Accidents at the Grand Gulf Early Site Permit Site

Release Category Description (Accident Class)	Core Damage Frequency (Ryr^{-1})	Environmental Risk: Population Dose (person-Sv Ryr^{-1})[a]	Fatalities (Ryr^{-1}): Early[b]	Fatalities (Ryr^{-1}): Latent[c]	Cost[d] ($ Ryr^{-1})	Land Requiring Decontamination[e] (ha Ryr^{-1})	Population Dose from Water Ingestion (person-Sv Ryr^{-1})[a]
0 No loss of containment	1.34×10^{-7}	9.53×10^{-6}	0	4.12×10^{-7}	3.05×10^{-2}	1.10×10^{-6}	3.52×10^{-8}
1 Transients followed by failure of high-pressure coolant makeup water and failure to depressurize in timely fashion	2.08×10^{-8}	1.27×10^{-6}	0	6.91×10^{-8}	6.98×10^{-3}	1.60×10^{-7}	5.55×10^{-9}
2 Short-term station blackout with reactor core isolation cooling (RCIC) failure, onsite power recovery in 8 hr	1.00×10^{-10}	2.43×10^{-9}	0	1.04×10^{-10}	1.79×10^{-6}	8.31×10^{-11}	5.69×10^{-12}
3 Station blackout with RCIC available for about 8 hr	1.00×10^{-10}	1.86×10^{-7}	0	8.61×10^{-9}	1.02×10^{-2}	5.79×10^{-7}	2.51×10^{-9}
4 Station blackout (more than 8 hr) with RCIC failure	1.00×10^{-10}	1.18×10^{-7}	0	5.25×10^{-9}	7.39×10^{-3}	4.11×10^{-7}	1.82×10^{-9}
5 Transients followed by failure of high pressure coolant makeup water, successful depressurization of reactor, failure of low-pressure coolant makeup water	1.00×10^{-10}	4.88×10^{-8}	0	2.00×10^{-9}	$6.4\ 1x \times 10^{-3}$	1.12×10^{-7}	6.03×10^{-10}

Table 5-13. (contd)

Release Category Description (Accident Class)	Core Damage Frequency (Ryr^{-1})	Population Dose (person-Sv Ryr^{-1})[(a)]	Fatalities (Ryr^{-1}) Early[(b)]	Fatalities (Ryr^{-1}) Latent[(c)]	Cost[(d)] (\$ Ryr^{-1})	Land Requiring Decontamination[(e)] (ha Ryr^{-1})	Population Dose from Water Ingestion (person-Sv Ryr^{-1})[(a)]
6 Transient, loss-of-coolant accident (LOCA), and anticipated transient without scram (ATWS) events with successful coolant makeup water, but potential prior failure of containment	1.00×10^{-10}	5.72×10^{-7}	0	2.61×10^{-8}	1.53×10^{-1}	1.06×10^{-5}	8.77×10^{-8}
7 Small/medium LOCA followed by failure of high-pressure coolant makeup water and failure to depressurize	3.91×10^{-10}	2.56×10^{-6}	0	1.15×10^{-7}	6.62×10^{-1}	4.34×10^{-5}	4.42×10^{-7}
8 LOCA followed by failure of high-pressure coolant makeup water	4.05×10^{-10}	4.24×10^{-6}	9.46×10^{-13}	1.93×10^{-7}	$1.10 \times 10^{+0}$	5.24×10^{-5}	1.08×10^{-6}
9 ATWS followed by boron injection failure and successful high-pressure coolant makeup water	1.70×10^{-10}	2.29×10^{-6}	5.91×10^{-14}	1.13×10^{-7}	5.15×10^{-1}	2.18×10^{-5}	7.28×10^{-7}
Total	$\mathbf{1.56 \times 10^{-7}}$	$\mathbf{2.08 \times 10^{-5}}$	$\mathbf{1.00 \times 10^{-12}}$	$\mathbf{9.45 \times 10^{-7}}$	$\mathbf{2.49 \times 10^{+0}}$	$\mathbf{1.31 \times 10^{-4}}$	$\mathbf{2.39 \times 10^{-6}}$

(a) To convert person-Sv to person-rem, multiply by 100.
(b) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).
(c) Latent fatalities are fatalities related to low doses or dose rates that could occur after a latent period of several (2 to 15) years.
(d) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).
(e) Land risk is farm land requiring decontamination prior to resumption of agricultural usage. To convert hectares (ha) to acres, multiply by 2.47.

Table 5-14. Mean Environmental Risk from the Surrogate AP1000 Severe Accidents at the Grand Gulf Early Site Permit Site

Release Category Description (Accident Class)		Core Damage Frequency (Ryr^{-1})	Environmental Risk					
			Population Dose (person-Sv Ryr^{-1})(a)	Fatalities (Ryr^{-1})		Cost(d) (\$ Ryr^{-1})	Land Requiring Decontamination(e) (ha Ryr^{-1})	Population Dose from Water Ingestion (person-Sv Ryr^{-1})(a)
				Early(b)	Latent(c)			
CFI	Intermediate containment failure, after core relocation but before 24 hr	1.89×10^{-10}	7.49×10^{-7}	0	3.73×10^{-7}	1.27×10^{-1}	1.03×10^{-5}	8.18×10^{-8}
CFE	Early containment failure, after onset of core damage but before core relocation	7.47×10^{-9}	3.07×10^{-5}	0	1.46×10^{-6}	$5.81 \times 10^{+0}$	3.75×10^{-4}	6.08×10^{-6}
IC	Intact containment	2.21×10^{-7}	7.98×10^{-6}	0	3.98×10^{-7}	3.66×10^{-2}	2.48×10^{-6}	7.55×10^{-8}
BP	Containment bypass, fission products released directly to environment	1.05×10^{-8}	9.91×10^{-5}	0	4.72×10^{-6}	$1.93 \times 10^{+1}$	1.08×10^{-3}	3.86×10^{-5}
CI	Containment isolation failure occurs prior to onset of core damage	1.33×10^{-9}	4.90×10^{-6}	0	2.63×10^{-7}	8.66×10^{-1}	5.51×10^{-5}	8.47×10^{-7}
CFL	Late containment failure occurring after 24 hr	3.45×10^{-13}	1.83×10^{-9}	0	8.21×10^{-11}	3.81×10^{-4}	3.07×10^{-8}	1.69×10^{-11}
Total		**2.40×10^{-7}**	**1.43×10^{-4}**	**$<1.00 \times 10^{-12}$**	**6.87×10^{-6}**	**$2.61 \times 10^{+1}$**	**1.53×10^{-3}**	**4.57×10^{-5}**

(a) To convert person-Sv to person-rem, multiply by 100.
(b) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).
(c) Latent fatalities are fatalities related to low doses or dose rates that could occur after a latent period of several (2 to 15) years.
(d) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).
(e) Land risk is farm land requiring decontamination prior to resumption of agricultural usage. To convert hectares (ha) to acres, multiply by 2.47.

Table 5-15. Comparison of Environmental Risk for an Advanced Boiling Water Reactor or a Surrogate AP1000 at the Grand Gulf Early Site Permit Site with Risk for Five Sites Evaluated in NUREG-1150

Reactor Site	Core Damage Frequency (Ryr^{-1})	50-mi (80-km) Population Dose Risk (person-Sv Ryr^{-1})[(a)]	Fatalities (Ryr^{-1})		Average Individual Fatality Risk (Ryr^{-1})	
			Early	Latent	Early	Latent Cancer
Grand Gulf[(b)]	4.0×10^{-6}	5×10^{-1}	8×10^{-9}	9×10^{-4}	3×10^{-11}	3×10^{-10}
Peach Bottom[(b)]	4.5×10^{-6}	$7 \times 10^{+0}$	2×10^{-8}	5×10^{-3}	5×10^{-11}	4×10^{-10}
Sequoyah[(b)]	5.7×10^{-5}	$1 \times 10^{+1}$	3×10^{-5}	1×10^{-2}	1×10^{-8}	1×10^{-8}
Surry[(b)]	4.0×10^{-5}	$5 \times 10^{+0}$	2×10^{-6}	5×10^{-3}	2×10^{-8}	2×10^{-9}
Zion[(b)]	3.4×10^{-4}	$5 \times 10^{+1}$	1×10^{-4}	2×10^{-2}	9×10^{-9}	8×10^{-9}
ABWR[(c)]	1.6×10^{-7}	2×10^{-5}	1×10^{-12}	9×10^{-7}	2×10^{-14}	3×10^{-12}
AP1000[(c)]	2.4×10^{-7}	1×10^{-4}	$<1 \times 10^{-12}$	7×10^{-6}	$< 1 \text{ X } 10^{-14}$	2×10^{-11}

(a) To convert person-Sv to person-rem, multiply by 100.
(b) Risks were calculated using the MACCS code and presented in NUREG-1150 (NRC 1990).
(c) Calculated with MACCS2 code using Grand Gulf site-specific input.

Table 5-16. Comparison of Environmental Risk from Severe Accidents Initiated by Internal Events for an Advanced Boiling Water Reactor and a Surrogate AP1000 at the Grand Gulf Early Site Permit Site with Risks for Current Reactors

Reactor Site	Core Damage Frequency (yr^{-1})	50-mi (80-km) Population Dose Risk (person-Sv Ryr^{-1})[a]
Current Reactor Maximum[b]	2.4×10^{-4}	6.9×10^{-1}
Current Reactor Mean[b]	3.6×10^{-5}	1.5×10^{-1}
Current Reactor Median[b]	2.8×10^{-5}	1.4×10^{-1}
Current Reactor Minimum[b]	1.9×10^{-6}	5.5×10^{-3}
ABWR[c]	1.6×10^{-7}	2.1×10^{-5}
AP1000[c]	2.4×10^{-7}	1.4×10^{-4}

(a) To convert person-Sv to person-rem, multiply by 100.
(b) Based on MACCS and MACCS2 calculations for current plants undergoing operating license renewal.
(c) Calculated with MACCS2 code using Grand Gulf site-specific input.

average individual early fatality and cancer fatality risks from reactor accidents in the safety goal policy statement (51 FR 30028). The policy statement expressed the Commission's policy regarding the acceptance level of radiological risk from nuclear power plant operation as follows:

- Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.

- Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

The following quantitative health objectives are used in determining achievement of the safety goals:

- The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of 1 percent (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed.

- The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of 1 percent (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

These quantitative health objectives are translated into two numerical objectives as follows:

- The individual risk of a prompt fatality from all "other accidents to which members of the U.S. population are generally exposed," such as fatal automobile accidents, is about 5 x 10^{-4} per year. One-tenth of one percent of this figure implies that the individual risk of prompt fatality from a reactor accident should be less than 5 x 10^{-7} per reactor year.

- "The sum of cancer fatality risks resulting from all other causes" for an individual is taken to be the cancer fatality rate in the United States, which is about 1 in 500 or 2 x 10^{-3} per year. One-tenth of 1 percent of this implies that the risk of cancer to the population in the area near a nuclear power plant because of its operation should be limited to 2 x 10^{-6} per reactor year.

MACCS2 calculates average individual early and latent cancer fatality risks. The average individual early fatality risk is calculated using the population distribution within 1.6 km (1 mi) of the plant boundary. The average individual latent cancer fatality risk is calculated using the population distribution within 16 km (10 mi) of the plant. For the plants considered in NUREG-1150, these risks were well below the Commission's safety goals. Risks calculated for the ABWR and surrogate AP1000 designs at the Grand Gulf ESP site are lower than the risks associated with the current-generation reactors considered in NUREG-1150, and are well below the Commission's safety goals.

The staff compared the core damage frequencies and population dose risk estimates for the ABWR and surrogate AP1000 reactors at the Grand Gulf ESP site with statistics summarizing the results of contemporary severe accident analyses performed for 28 current-generation operating reactors at 23 sites. The results of these analyses are included in the final site-specific Supplements 1 through 20 to the GEIS (NRC 1996), and in the environmental reports included with license renewal applications for those plants for which supplements to the GEIS have not been published. All of the analyses were completed after publication of NUREG-1150, and 23 of the analyses used MACCS2, which was released in 1997. Table 5-16 shows that the core damage frequencies estimated for the ABWR and surrogate AP1000 reactors are significantly lower than those of current-generation reactors. Similarly, the population doses estimated for the advanced reactors at the Grand Gulf ESP site are well below the mean and median values for current generation reactors undergoing license renewal.

The population dose estimates and risks for the Grand Gulf ESP site in Tables 5-13 through 5-16 are based on the 2002 population for the region. Growth estimates in the environmental report indicate that the population in the region is expected to grow by a factor of 1.18 from 2002 to 2070 (SERI 2005a). The population risks for the ESP site may be multiplied by this factor to account for population growth. Even with this increase, the risks associated with either the ABWR or surrogate AP1000 reactors are low.

The staff compared the risk estimates given in Tables 5-13 and 5-14, the air pathway risks in Tables 5-15 and 5-16, and the average individual early fatality and average individual latent cancer fatality risks in Table 5-15 with the Commission's safety goals. Preliminary information on the IRIS and the ACR-700 reactor designs indicates that the surrogate AP1000 will likely bound the risk for these advanced reactor designs. Similarly, the ESBWR risk is expected to be bounded by the risk for the ABWR. Based on these comparisons, the staff concludes that the impacts for the proposed Grand Gulf ESP site for the air pathway releases for severe accidents would be small for operation of advanced LWRs.

For the evaluation in this EIS to bound a non-LWR reactor design selected at the CP or COL stage, an applicant referencing the Grand Gulf ESP would need to demonstrate that the environmental impacts of the air pathway releases for severe accidents at the Grand Gulf ESP site remain bounded by the environmental impacts from the surrogate designs.

5.10.2.2 Surface Water Pathways

Surface water pathways are an extension of the air pathway. These pathways cover the effects of radioactive material deposited on open bodies of water. The surface water pathways of interest include exposure to external radiation from submersion in water and activities near the water, ingestion of water, and ingestion of fish and other aquatic creatures. Of these pathways, the MACCS2 code only evaluates the ingestion of contaminated water. The risks associated with this surface water pathway calculated for the Grand Gulf ESP site are included in the last columns of Tables 5-13 and 5-14.

For each accident class, the population dose risk from ingestion of water is a small fraction of the dose risk from the air pathway. These dose estimates are conservative because there are no known downstream intakes within 160 km (100 mi) of the Grand Gulf ESP site that use the Mississippi River as a potable water supply. None of the public water supply systems in Mississippi that use surface water as a source are within 80 km (50 mi) of the ESP site (SERI 2005a), and there are only five public water supply systems in Louisiana within 80 km (50 mi) of the site that use surface water as a source (LDEQ 2001). Four of these withdraw water from Lake Bruin, which is about 13 km (8 mi) west-southwest of the site. The other water supply system that uses surface water is about 64 km (40 mi) to the south-southwest.

The Mississippi River is used for recreational activities including swimming and fishing. Doses from these surface water pathways are not modeled in MACCS or MACCS2. The GEIS (NRC 1996) considered typical population exposure risk for the aquatic food pathway for plants located on large rivers. For plants on large rivers, the population dose from the food pathway was well below the population dose from the air pathway. The proposed Grand Gulf ESP site is classified as being on a large river. Analysis of water-related exposure pathways at the Fermi reactor (NRC 1981b) suggests that population exposures from swimming are significantly lower than exposures from the aquatic ingestion pathway.

After considering the water ingestion dose estimates and the GEIS (NRC 1996), the staff concludes that the impacts for the proposed Grand Gulf ESP site from surface water pathway releases for severe accidents are small for operation of ABWR and surrogate AP1000 reactors.

In a similar fashion to the air pathway, the environmental impacts of the surface water pathways for other advanced LWRs are expected to be bounded by the ABWR and the surrogate AP1000. For the evaluation in this EIS to bound a non-LWR reactor design selected at the CP or COL stage, an applicant referencing the Grand Gulf ESP would need to demonstrate that the environmental impacts of the surface water pathway releases for severe accidents at the Grand Gulf ESP site remain bounded by the environmental impacts from the surrogate designs.

5.10.2.3 Groundwater Pathway

Neither MACCS nor MACCS2 evaluates the environmental risks associated with severe accident releases of radioactive material to groundwater. However, this pathway has been addressed in the GEIS in the context of renewal of operating licenses for the current generation reactors (NRC 1996). The GEIS assumes a 1×10^{-4} Ryr^{-1} probability of occurrence of a severe accident with a basemat melt-through leading to potential groundwater contamination, and the staff concluded that groundwater generally contributed a small fraction of the risk attributable to the atmospheric pathway. Although the staff assumed that the probability of occurrence of a release via the groundwater pathway is significantly larger than a release via the atmospheric pathway for either the ABWR or the surrogate AP1000, the groundwater pathway is more tortuous and affords a greater time for implementing protective actions and, therefore, results in a lower risk to the public. As a result, the staff concludes that the risks associated with releases to groundwater are small for the proposed Grand Gulf ESP site.

5.10.2.4 Summary of Severe Accident Impacts

Although SERI chose the PPE approach in the overall ESP application, it based its evaluation of the environmental impact of severe accidents on characteristics of the ABWR and the surrogate AP1000 reactor designs (SERI 2005a). The NRC staff reviewed the analysis in the environmental report and conducted its own confirmatory analysis using the MACCS2 code. The results of both the SERI analysis and the NRC analysis indicate that the environmental risks associated with severe accidents if an advanced LWR were to be located at the Grand Gulf ESP site would be small compared to risks associated with operation of current-generation reactors at the Grand Gulf site and other sites. These risks are well below the Commission's safety goals. On these bases, the staff concludes that the probability weighted consequences of severe accidents at the Grand Gulf ESP site are of SMALL significance for an advanced LWR. The environmental impacts of severe accidents for designs not evaluated in this EIS, including gas-cooled designs, are not resolved because necessary design information is lacking. Consequently, these impacts would need to be evaluated at the CP or COL stage. For the evaluation in this EIS to bound an LWR reactor design selected at the CP or COL stage, the staff would need to verify that the environmental impacts of severe accidents at the Grand Gulf ESP site remain bounded by the environmental impacts discussed herein.

5.10.3 Summary of Postulated Accident Impacts

The staff evaluated the environmental impacts from DBAs and severe accidents using the ABWR and the surrogate AP1000 to characterize the environmental impacts from advanced LWRs. As described previously, preliminary information on the IRIS and the ACR-700 reactor designs indicates that the surrogate AP1000 would likely bound the source terms for the design basis and severe accidents. Consequently, the staff considers it likely that doses from surrogate AP1000 DBAs would bound the doses from DBAs for the IRIS and ACR-700 designs, and that the probability weighted consequences of severe accidents for the surrogate AP1000 would bound the probability weighted consequences for IRIS and ACR-700 severe accidents. Similarly, the accident source terms, DBA doses, and probability weighted consequences of severe accidents for an ESBWR are expected to be bounded by those for an ABWR.

Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the potential environmental impacts from a postulated accident from the operation of one or more additional nuclear power units would be SMALL for the operation of advanced LWRs. The staff did not explicitly evaluate the design basis or severe accident impacts for gas-cooled reactors because of the lack of necessary design information. Consequently, the impacts involving gas-cooled reactor designs are not resolved.

5.11 Measures and Controls to Limit Adverse Impacts During Operation

The following general measures and controls on which the staff relied in their evaluation of environmental impact during operation of the proposed new unit or units at the Grand Gulf ESP site include those for which SERI would be required by applicable permits (Federal, State, and local) and authorizations as well as the feasible measures and controls contained in Table 5.10-1 of the environmental report (SERI 2005a):

- Compliance with the applicable Federal, State, and local laws, ordinances, and regulations that prevent or minimize adverse environmental impact (for example, solid waste management, erosion and sediment control, air emission control, noise control, storm water management, spill response and cleanup, hazardous material management)
- Compliance with applicable requirements of permits and licenses required for operation (for example, NPDES permit and operating license).

Some of these permits or approvals include:

- Compliance with NPDES permit requirements imposed on water discharges from the new unit(s) (environmental report, Section 5.2)
- Compliance with MDEQ permit limits and regulations for installing and operating air emission sources (environmental report, Section 5.3)
- Compliance with SERI and Entergy procedures applicable to environmental control and management.

SERI specifically identified the following general plans or specific mitigation measures in its environmental report on which the staff relied in its evaluation:

- Incorporating drift eliminators into design of cooling towers to minimize potential for salt deposition (environmental report, Sections 5.1.1, 5.3.3)
- Maintaining natural drainage patterns as much as practicable (environmental report, Section 5.2.1)
- Maintaining sedimentation basins to minimize sedimentation to Hamilton Lake (environmental report, Sections 5.2.1, 5.2.2)
- Disposing dredge spoils as required by ACE and MDEQ (environmental report, Section 5.2.2)
- Designing intake pipes/screens to minimize potential for impingement and entrainment (environmental report, Section 5.3.1)

- Maintaining/restoring bank stabilization following any construction on the river shore (environmental report, Section 5.3.2)
- Using proven industrial hygiene principles to reduce worker exposure to microorganisms (environmental report, Section 5.3.4)
- Treating effluents containing biocides or other chemicals prior to discharge, in compliance with NPDES permit requirements. Onsite sanitary waste treatment would include tertiary treatment. SERI would also develop and implement a Storm Water Pollution Prevention Plan to manage runoff (environmental report, Section 5.5.1)
- Collecting and storing chemical wastes and waste petroleum products; disposing or recycling offsite at licensed facilities (environmental report, Section 5.5.1)
- Developing and implementing ALARA requirements to mitigate occupational exposures to radioactive and mixed wastes (environmental report, Section 5.5.2)
- Instituting flexible work hours and additional road improvements, such as traffic lights or turn lanes, as needed to mitigate effects on local traffic (environmental report, Section 5.8.2)
- Increasing revenue to Claiborne County and the town of Port Gibson to support emergency services (environmental report, Section 5.8.2).

SERI evaluated the measures and controls shown in Table 5.10-1 of its environmental report (SERI 2005a) and considered them feasible from both a technical and economic standpoint. In addition, SERI expects that these measures and controls would be adequate for avoiding or mitigating potential adverse impact associated with operation of the new unit(s). The staff considered these measures and controls in its evaluation of station operation impact.

5.12 Summary of Operational Impacts

Table 5-17 shows impact level categories as SMALL, MODERATE, or LARGE as a measure of their expected adverse impacts, if any. A brief statement in the "comments" column explains the basis for the impact level. Some impacts, such as the addition of tax revenue for the local economies, are likely to be beneficial. The beneficial aspect is also reflected in the "comments" column. Impacts related to water use and water quality were estimated for the purposes of comparison to alternatives, but are not resolved because significant information on the proposed action is lacking at the ESP stage. Other issues (effects of EMF, accident impacts for other-than-LWR designs) are not resolved, because of the lack of information on source terms or impacts. An applicant for a CP or COL that references the Grand Gulf ESP would need to provide this information to enable analysis at that time.

Table 5-17. Characterization of Operational Impacts at the Grand Gulf Early Site Permit Site

Category	Comments	Impact Level
Land-use impacts		–
Site and vicinity	Operation of new unit(s) within existing site. Minimal impacts from cooling tower drift.	SMALL
Transmission line rights-of-way and offsite areas	Upgrade of existing transmission line rights-of-way would be needed.	SMALL
Air quality impacts	Air quality impacts would be small because the emission sources would be operated intermittently and emissions would be within Federal, State, and local air quality limits.	SMALL
Water-related impacts		–
Hydrological alterations	No significant changes in surface hydrology would result from plant operation.	SMALL
Water use	Water use from the Mississippi River would be a small fraction of even the lowest flows.	Unresolved, likely to be SMALL
Water quality	Impact on water quality would be small and would be regulated by the Mississippi Department of Environmental Quality.	Unresolved, likely to be SMALL
Ecological impacts		–
Terrestrial ecosystems	No detectable impacts are expected.	SMALL
Aquatic ecosystems	Impact would be minimal because of the use of cooling towers.	SMALL
Threatened and endangered species	No impacts on Federally or State-listed species are likely to be detectable.	SMALL
Socioeconomic impacts		–
Physical impacts		SMALL
Workers/public	Workers would use protective equipment and receive training to mitigate any possible impact. The Grand Gulf location is relatively remote, so the public would not be affected.	–
Buildings	No impacts on onsite or offsite buildings.	–
Roads	Upgrades before or during construction would cover the lesser impact of operational workforces.	–
Aesthetics	Visual impacts would be minimal because of the remote location.	–

Table 5-17. (contd)

Category	Comments	Impact Level
Socioeconomic impacts (contd)		–
Demography	Number of new employees would be small in proportion to population base in the region. If in-migrating population settles according to current patterns for Grand Gulf Unit 1, the impact on Port Gibson could be moderate to large.	LARGE
Social and economic		LARGE Beneficial
Economy	Increased jobs would benefit the area economically, up to a moderate beneficial impact (Warren County) is possible.	–
Taxes	Degree of impact depends on distribution of revenues to county or state; generally impact is beneficial, especially for property taxes. Under current tax law, beneficial impact of additional taxes would be large for Claiborne County.	–
Infrastructure and community services		MODERATE
Transportation	Improvements made for construction would be sufficient to cover any adverse impact from additional operational workers.	–
Recreation	Overall impacts on recreation would be minimal because of the remote location and fact that the proposed ESP facility would be operating in an area with an existing nuclear power facility.	–
Housing	Adequate housing is available in the region to handle operational workers.	–
Public services	Adequate in region for any population increase resulting from operation workforce. Claiborne County may be more affected by demands on police, fire, and medical resources.	–
Education	Current schools and planned additions would handle additional students. Claiborne County could be more affected if worker distribution is similar to that for existing Grand Gulf Unit 1.	–
Historic and cultural resources	A cultural resource procedure would be implemented for minimizing impacts from routine land disturbances.	SMALL

Table 5-17. (contd)

Category	Comments	Impact Level
Environmental justice	Physical impacts would be small. Economic impacts would be large beneficial under existing tax law.	LARGE Beneficial
Nonradiological health impacts	Health impacts would be monitored and controlled in accordance with Occupational Safety and Health Administration regulations.	SMALL, Unresolved for EMF
Radiological health impacts	Doses to public and occupational workers would be monitored and controlled in accordance with NRC limits.	SMALL
Impacts of postulated accidents		–
Design basis accidents (DBAs)	Doses for advanced LWRs are expected to be a small fraction of the regulatory dose limits. CP or COL applicant would demonstrate that doses for postulated DBAs on chosen gas-cooled reactor designs are within regulatory limits.	SMALL for LWR, Unresolved for gas-cooled designs
Severe accidents	Risks for advanced LWRs would be small. If a gas-cooled reactor is selected at the CP or COL stage, then applicant would analyze the severe accident impact for gas-cooled reactors.	SMALL for LWR, Unresolved for gas-cooled designs

5.13 References

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6.0 Fuel Cycle, Transportation, and Decommissioning

This chapter addresses the environmental impacts from (1) the uranium fuel cycle and solid waste management, (2) transportation of radioactive material, and (3) decommissioning for the proposed Grand Gulf early site permit (ESP) site. Distinctions between the impacts of advanced light-water reactor (LWR) designs and the gas-cooled reactor designs are discussed.

In its evaluation of uranium fuel cycle impacts for the Grand Gulf ESP site, System Energy Resources, Inc. (SERI) used the plant parameter envelope (PPE) approach for the advanced LWR designs but not for the two gas-cooled reactors. In its evaluation of the impacts from transportation of radioactive materials, SERI did not use the PPE approach, but rather evaluated each reactor design individually. An applicant for a construction permit (CP) or a combined license (COL) referencing the Grand Gulf ESP would, therefore, have to perform a new evaluation if a different design is proposed at that stage.

6.1 Fuel Cycle Impacts and Solid Waste Management

This section discusses the environmental impacts from the uranium fuel cycle and solid waste management for both the advanced LWR designs and gas-cooled reactor designs. The impacts of the two types of design are presented separately because Title 10 of the Code of Federal Regulations (CFR), Section 51.51 (10 CFR 51.51) provides specific criteria for evaluating the environmental impacts for only LWR designs. Consequently, issues related to fuel cycle impacts and solid waste management are not resolved because of the lack of data to validate impacts from gas-cooled designs.

6.1.1 Light Water Reactors

The regulations in 10 CFR 51.51(a) state that

> Every environmental report prepared for the construction permit stage of a light water cooled nuclear power reactor, and submitted on or after September 4, 1979, shall take Table S–3, Table of Uranium Fuel Cycle Environmental Data, as the basis for evaluating the contribution of the environmental effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials and management of low level wastes and high level wastes related to uranium fuel cycle activities to the environmental costs of licensing the nuclear power reactor. Table S–3 shall be included in the environmental report and may be supplemented by a discussion of the environmental significance of the data set forth in the table as weighed in the analysis for the proposed facility.

The PPE for the new unit or units at the Grand Gulf ESP site uses the bounding input parameters from the following LWR designs:

- Advanced CANDU (CANada Deuterium Uranium Reactor) (ACR-700) – This reactor, developed by Atomic Energy Canada Limited, is an evolutionary extension of CANDU 6 plant using very slightly enriched uranium fuel and light water coolant.

- Advanced Boiling Water Reactor (ABWR) – This reactor, developed by General Electric Company, is a standardized plant that has been certified under the U.S. Nuclear Regulatory Commission (NRC) requirements in 10 CFR Part 52 (Appendix A). The ABWR is fueled with slightly enriched uranium and uses a light water cooling system.

- Advanced Pressurized Water Reactor (AP1000) – This is an earlier version of the AP1000 reactor final design developed by Westinghouse Electric Company and subsequently approved by the NRC, using slightly enriched uranium and a light water cooling system. This design is not the AP1000 that has received final design approval from the NRC; therefore, this design will be referred to as the “surrogate AP1000.”

- Economic Simplified Boiling Water Reactor (ESBWR) – This reactor, developed by General Electric Company, is fueled with slightly enriched uranium and uses a light water cooling system.

- International Reactor Innovative and Secure (IRIS) next-generation pressurized water reactor (PWR) – This reactor, under development by a consortium led by Westinghouse Electric Company, is a modular LWR.

These light water designs all use uranium dioxide fuel; therefore, Table S–3 (10 CFR 51.51(b)) can be used to assess environmental impacts. Table S–3 values are normalized for a reference 1000-MW(e) LWR at an 80 percent capacity factor. The 10 CFR 51.51(b) Table S–3 values are reproduced in Table 6-1. The PPE power rating for the Grand Gulf ESP site is 8600 MW(t) with a net electrical output of up to 3000 MW(e) (SERI 2005a).

Specific categories of natural resource use are included in Table S–3 (see Table 6-1). These categories relate to land use, water consumption and thermal effluents, radioactive releases, burial of transuranic and high-level and low-level wastes, and radiation doses from transportation and occupational exposures. In developing Table S–3, the staff considered two fuel cycle options–no recycle and uranium-only recycle–that differed in the treatment of spent fuel removed from a reactor. “No recycle” treats all spent fuel as waste to be stored at a Federal waste repository; “uranium-only recycle” involves reprocessing spent fuel to recover unused uranium and return it to the system. Neither cycle involves the recovery of plutonium. The contributions in Table S–3 resulting from reprocessing, waste management, and transportation of wastes are maximized for both of the two fuel cycles (uranium-only and no recycle); that is, the identified environmental impacts are based on the cycle that results in the greater impact. The uranium fuel cycle is defined as the total of those operations and processes associated with provision, utilization, and ultimate disposition of fuel for nuclear power reactors.

Table 6-1. Table S–3 from 10 CFR 51.51(b), Table of Uranium Fuel Cycle Environmental Data[1]

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Natural Resource Use		
Land (acres):		
Temporarily committed[2]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to a 110 MWe coal-fired power plant.
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to 95 MWe coal-fired power plant.
Water (millions of gallons):		
Discharged to air	160	=2 percent of model 1,000 MWe LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	<4 percent of model 1,000 MWe LWR with once-through cooling.
Fossil fuel:		
Electrical energy (thousands of MW-hr)	323	<5 percent of model 1,000 MWe LWR output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45 MWe coal-fired power plant.
Natural gas (millions of standard cubic feet)	135	<0.4 percent of model 1,000 MWe energy output.
Effluents–Chemical (MT)		
Gases (including entrainment):[3]		
SO_x	4,400	
NO_x[4]	1,190	Equivalent to emissions from 45 MWe coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1,154	

Table 6-1. (contd)

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Other gases:		
F	.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards—below level that has effects on human health.
HCl	.014	
Liquids:		
SO^{-}_{4}	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3–600 cfs., NO_3–20 cfs., Fluoride–70 cfs.
NO^{-}_{3}	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^{-}	8.5	
Na^{+}	12.1	
NH_3	10.0	
Fe	.4	
Tailings solutions (thousands of MT)	240	From mills only—no significant effluents to environment.
Solids	91,000	Principally from mills-no significant effluents to environment.
Effluents—Radiological (curies)		
Gases (including entrainment):		
Rn–222	....	Presently under reconsideration by the Commission.
Ra–226	.02	
Th–230	.02	
Uranium	.034	
Tritium (thousands)	18.1	
C–14	24	
Kr–85 (thousands)	400	
Ru–106	.14	Principally from fuel reprocessing plants.
I–129	1.3	
I–131	.83	
Tc–99	....	Presently under consideration by the Commission.
Fission products and transuranics	.203	
Liquids:		
Uranium and daughters	2.1	Principally from milling—included tailings liquor and returned to ground—no effluents; therefore, no effect on environment.
Ra–226	.0034	From UF_6 production.
Th–230	.0015	
Th–234	.01	From fuel fabrication plants—concentration 10 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-6}	

Table 6-1. (contd)

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
Solids (buried on site):		
Other than high level (shallow)	11,300	9,100 Ci comes from low level reactor wastes and 1,500 Ci comes from reactor decontamination and decommissioning—buried at land burial facilities. 600 Ci comes from mills—included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^7	Buried at Federal Repository.
Effluents—thermal (billions of British thermal units)	4,063	<5 percent of model 1,000 MWe LWR
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management.

[1] In some cases where no entry appears it is clear from the background documents that the matter was addressed and that, in effect, the Table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the Table. Table S–3 does not include health effects from the effluents described in the Table, or estimates of releases of Radon-222 from the uranium fuel cycle or estimates of Technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in the “Environmental Survey of the Uranium Fuel Cycle,” WASH–1248, April 1974; the “Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle,” NUREG–0116 (Supp.1 to WASH–1248, NRC 1976); the “Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle,” NUREG–0216 (Supp. 2 to WASH–1248) (NRC 1977b); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM–50–3. The contributions from reprocessing, waste management and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor which are considered in Table S–4 of §51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S–3A of WASH-1248.

[2] The contributions to temporarily committed land from reprocessing are not prorated over 30 years, since the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

[3] Estimated effluents based upon combustion of equivalent coal for power generation.

[4] 1.2 percent from natural gas use and process.

During the Carter administration, the Nuclear Nonproliferation Act of 1978, Pub. L. No. 95-242 (22 USC 3201 *et seq.*), was enacted; it significantly impacted the disposition of spent nuclear fuel by indefinitely deferring the commercial reprocessing and recycling of plutonium produced in the U.S. commercial nuclear power program. While the ban on the reprocessing of spent fuel was lifted during the Reagan administration, economic circumstances changed, reserves of uranium ore increased, and the stagnation of the nuclear power industry provided little incentive for industry to resume reprocessing. During the 109th Congress, the Energy Policy Act of 2005, Pub. L. No. 109-58 (119 Stat. 594 [2005]), was enacted. It authorized the U.S. Department of Energy (DOE) to conduct an advanced fuel recycling technology research and development

| program to evaluate proliferation-resistant fuel recycling and transmutation technologies that minimize environmental or public health and safety impacts. Consequently, while Federal policy does not prohibit reprocessing, additional DOE efforts would be required before commercial reprocessing and recycling of spent nuclear fuel produced from U.S. commercial nuclear power plants could commence.

| The no-recycle option is presented schematically in Figure 6-1. Natural uranium is mined in either open-pit or underground mines or by an in situ leach solution mining process. In situ leach mining, the primary form of mining in the United States today, involves injecting a lixiviant solution into the uranium ore body to dissolve uranium and then pumping the solution to the surface for further processing. The ore or in situ leach solution is transferred to mills where it is processed to produce uranium oxide or "yellowcake." A conversion facility prepares the uranium oxide by converting it to uranium hexafluoride, which is then processed at an enrichment facility to increase the percentage of the more fissile isotope uranium-235 and decrease the percentage if the non-fissile isotope uranium-238. At a fuel-fabrication facility, the enriched uranium, which is approximately 5 percent uranium-235, is then converted to uranium dioxide (UO_2). The UO_2 is pelletized, sintered, and inserted into tubes to form fuel assemblies. The fuel assemblies are placed in the reactor to produce power. When the content of the uranium-235 reaches a point where the nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are withdrawn from the reactor. After onsite storage for sufficient time to allow for short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies would be transferred to a waste repository. Disposal of spent fuel elements in a repository constitutes the final step in the no-recycle option.

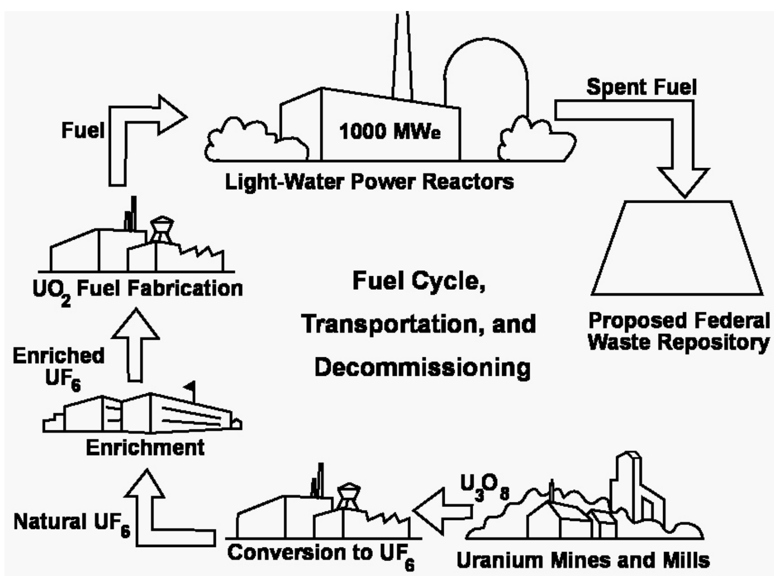

Figure 6-1. The Uranium Fuel Cycle: No-Recycle Option (derived from NRC 1999)

The following assessment of the environmental impacts of the fuel cycle as related to the operation of the proposed project is based on the values given in Table S–3 (see Table 6-1) and the staff's analysis of the radiological impact from radon and technetium. In the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996), the staff provides a detailed analysis of the environmental impacts from the uranium fuel cycle. Although the GEIS is specific to the impacts related to license renewal, the information is relevant to this review because the advanced LWR designs considered here use the same type of fuel; the staff's analyses in Section 6.2.3 of the GEIS are summarized and incorporated by reference here.

The fuel cycle impacts in Table S–3 are based on a reference 1000-MW(e) LWR operating at an annual capacity factor of 80 percent for a net electric output of 800 MW(e). In the following review and evaluation of the environmental impacts of the fuel cycle, the staff used the stated capacity factor in the SERI PPE of 96 percent with a total net electric output of 3000 MW(e) for the ESP site (SERI 2005a); this results in approximately four times the impact values in Table S–3 (see Table 6-1). Throughout Chapter 6, this will be referred to as the 1000-MW(e) LWR scaled model, reflecting 3000 MW(e) for the site.

Recent changes in the fuel cycle may have some bearing on environmental impacts; however, as discussed below, the staff is confident that the contemporary fuel cycle impacts below are those identified in Table S–3.

The values in Table S–3 were calculated from industry averages for the performance of each type of facility or operation within the fuel cycle. Recognizing that this approach meant that there would be a range of reasonable values for each estimate, the staff followed the policy of choosing the assumptions or factors to be applied so that the calculated values would not be underestimated. This approach was intended to ensure that the actual environmental impacts would be less than the quantities shown in Table S–3 for all LWR nuclear power plants within the widest range of operating conditions. Many subtle fuel cycle parameters and interactions were recognized by the staff as being less than the precision of the estimates and were not considered or were considered but had no effect on the Table S–3 calculations. For example, to determine the quantity of fuel required for a year's operation of a nuclear power plant in Table S–3, the staff defined the model reactor as a 1000-MW(e) light water reactor operating at 80-percent capacity with a 12-month fuel reloading cycle and an average fuel burnup of 33,000 MWd/MTU. This is a "reactor reference year" or "reference reactor year" depending on the source (either Table S–3 or the GEIS), but it has the same meaning. The sum of the initial fuel loading plus all of the reloads for the lifetime of the reactor can be divided by the now more likely 60-year (40-year initial operating license term and 20-year license renewal term) lifetime to obtain an average annual fuel requirement. This was done for both boiling water reactors (BWRs) and PWRs; the higher annual requirement, 35 metric tonnes (MT) of uranium made into fuel for a BWR, was chosen in the GEIS as the basis for the reference reactor year. A number of fuel management improvements have been adopted by nuclear power plant

| managers to achieve higher performance and to reduce fuel and separative work (enrichment) requirements. Since Table S–3 was promulgated, these improvements have reduced the annual fuel requirement.

Another change is the elimination of the U.S. restrictions on the importation of foreign uranium. | The economic conditions of the uranium market favor utilization of foreign uranium at the expense of the domestic uranium industry. These market conditions have forced the closing of most U.S. uranium mines and mills, substantially reducing the environmental impacts in the | United States from these activities. Factoring in changes to the fuel cycle suggests that the | environmental impacts on mining and tail millings could drop levels below those given in | Table S–3; however, Table S–3 estimates have not been reduced.

| Section 6.2 of the GEIS discusses the sensitivity to recent changes in the fuel cycle on the environmental impacts in greater detail.

6.1.1.1 Land Use

The total annual land requirement for the fuel cycle supporting the 1000-MW(e) LWR scaled | model is about 183 ha (452 ac). Approximately 20 ha (52 ac) are permanently committed land, | and 162 ha (400 ac) are temporarily committed. A “temporary” land commitment is a commitment for the life of the specific fuel cycle plant (e.g., a mill, enrichment plant, or succeeding plants). Following completion of decommissioning, such land can be released for unrestricted use. “Permanent” commitments represent land that may not be released for use after plant shutdown and/or decommissioning because decommissioning activities do not result in removal of sufficient radioactive material to meet the limits in 10 CFR Part 20, Subpart E for | release of that area for unrestricted use. Of the 162 ha (400 ac) of temporarily committed land, | 113 ha (280 ac) are undisturbed and 49 ha (120 ac) are disturbed (SERI 2005a). In | comparison, a coal-fired power plant with the same MW(e) output as the LWR scaled model | and that uses strip-mined coal requires the disturbance of about 324 ha (800 ac) per year for | fuel alone. The staff concludes that the impacts on land use to support the 1000-MW(e) LWR scaled model would be small.

6.1.1.2 Water Use

| The principal water use for the fuel cycle supporting a 1000-MW(e) LWR scaled model is that required to remove waste heat from the power stations supplying electrical energy to the enrichment step of this cycle. Scaling from Table S–3, of the total annual water use | of 1.72×10^8 m^3 (4.55×10^{10} gal), about 1.7×10^8 m^3 (4.44×10^{10} gal) are required for the removal of waste heat, assuming that these plants use once-through cooling. Other water

uses involve the discharge to air (e.g., evaporation losses in process cooling) of about 2.42×10^6 m^3/yr (6.40×10^8 gal/yr) and water discharged to ground (e.g., mine drainage) of about 1.92×10^6 m^3/yr (5.08×10^8 gal/yr).

On a thermal effluent basis, annual discharges from the nuclear fuel cycle are about 4 percent of the 1000-MW(e) LWR scaled model using once-through cooling. The consumptive water use of 2.42×10^6 m^3/yr (6.40×10^8 gal/yr) is about 2 percent of the 1000-MW(e) LWR scaled model using cooling towers. The maximum consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel cycle use cooling towers) would be about 6 percent of the 1000-MW(e) LWR scaled model using cooling towers. Under this condition, thermal effluents would be negligible. The staff concludes that the impacts on water use for these combinations of thermal loadings and water consumption would be small relative to the water use and thermal discharges.

6.1.1.3 Fossil Fuel Impacts

Electric energy and process heat are required during various phases of the fuel cycle process. The electric energy is usually produced by the combustion of fossil fuel at conventional power plants. Electric energy associated with the fuel cycle represents about 5 percent of the annual electric power production of the reference 1000-MW(e) LWR. Process heat is primarily generated by the combustion of natural gas. This gas consumption, if used to generate electricity, would be less than 0.4 percent of the electrical output from the model plant. The staff concludes that the fossil fuel impacts from the direct and indirect consumption of electric energy for fuel cycle operations would be small relative to the net power production of the proposed project.

6.1.1.4 Chemical Effluents

The quantities of chemical, gaseous, and particulate effluents from fuel cycle processes are given in Table S–3 (see Table 6-1) for the reference 1000-MW(e) LWR. The quantities of effluents would be approximately four times greater for the reference 1000-MW(e) LWR scaled model. The principal effluents are SO_x, NO_x, and particulates. Based on data in *The Seventh Annual Report of the Council on Environmental Quality*, these emissions constitute a small additional atmospheric loading in comparison with the emissions from the stationary fuel combustion and transportation sectors in the United States. The fuel cycle emissions constitute about 0.08 percent of the annual national releases for each of these effluents (CEQ 1976).

Liquid chemical effluents produced in fuel cycle processes are related to fuel enrichment and fabrication and may be released to receiving waters. These effluents are usually present in dilute concentrations such that only small amounts of dilution water are required to reach levels of concentration that are within established standards. Table S–3 (see Table 6-1) specifies the amount of dilution water required for specific constituents. Additionally, all liquid discharges into the navigable waters of the United States from plants associated with the fuel cycle operations will be subject to requirements and limitations set by an appropriate Federal, State, regional, | local, or affected Native American Tribal regulatory agency.

Tailings solutions and solids are generated during the milling process and are not released in quantities sufficient to have a significant impact on the environment.

The staff determined that the impacts of these chemical effluents would be small.

6.1.1.5 Radioactive Effluents

Radioactive effluents estimated to be released to the environment from waste management activities and certain other phases of the fuel cycle process are set forth in Table S–3 (see | Table 6-1). Using these data, the staff calculated for 1 year of operation of the 1000-MW(e) | LWR scaled model, the 100-year involuntary environmental dose commitment to the | U.S. population from the LWR-supporting fuel cycle. These calculations estimate that the overall whole body gaseous dose commitment to the U.S. population from the fuel cycle (excluding reactor releases and the dose commitments resulting from radon-222 and technetium-99) would be approximately 16 person-Sv (1600 person-rem) per year of operation of the 1000-MW(e) LWR scaled model; this reference reactor year is scaled to reflect the total electric power rating for the site for a year.

The additional whole body dose commitment to the U.S. population from radioactive liquid effluents from all fuel cycle operations other than reactor operation would be approximately | 8 person-Sv (800 person-rem) per year of operation. Thus, the estimated 100-year environmental dose commitment to the U.S. population from radioactive gaseous and liquid releases because of these portions of the fuel cycle is approximately 24 person-Sv (2400 person-rem) to the whole body per reference reactor year.

Currently, the radiological impacts associated with radon-222 and technetium-99 release are not addressed in Table S–3. Principal radon releases occur during mining and milling operations and as emissions from mill tailings, whereas principal technetium-99 releases occur from gaseous diffusion enrichment facilities. SERI provided an assessment of radon-222 and technetium-99 in its response to a request for additional information on February 3, 2005 | (SERI 2005b). The staff's evaluation in this environmental impact statement (EIS) relied on the | information discussed in the GEIS.

| In Section 6.2 of the GEIS, the staff estimated the radon-222 releases from mining and milling operation, and from mill tailings for each year of operations of the reference 1000-MW(e) LWR. The estimated releases of radon-222 for the reference reactor year for the 1000-MW(e) LWR

scaled model, or for the total electric power rating for the site for a year, is approximately 7.7×10^{14} Bq (20,800 Ci). Of this total, about 78 percent would be from mining, 15 percent from milling operations, 7 percent from inactive tails prior to stabilization. For radon releases from stabilized tailings, the staff assumed that the scaled model would result in an emission of 1.5×10^{11} Bq (4 Ci) per site year; i.e., four times the GEIS estimate for the reference reactor year. The major risks from radon-222 are from exposure to the bone and the lung, although there is a small risk from exposure to the whole body. The organ-specific dose weighting factors from 10 CFR 20.1003 were applied to the bone and lung doses to estimate the 100-year dose commitment from radon-222 to the whole body. The estimated 100-year environmental dose commitment from mining, milling, and tailings prior to stabilization for each site year (assuming the 1000-MW(e) LWR scaled model) would be approximately 37 person-Sv (3700 person-rem) to the whole body. From stabilized tailings piles, the estimated 100-year environmental dose commitment would be approximately 0.71 person-Sv (71 person-rem) to the whole body. Additional insights regarding Federal policy/resource perspectives concerning institutional controls comparisons with routine radon-222 exposure and risk and long-term releases from stabilized tailings piles are discussed in the GEIS. SERI provided an assessment of radon-222 and technetium-99 in its response to a request for additional information on February 3, 2005 (SERI 2005b). The evaluation in this EIS relied on the information discussed in the GEIS.

Also as discussed in the GEIS, the staff considered the potential health effects associated with the releases of technetium-99. The estimated releases of technetium-99 for the reference reactor year for the 1000-MW(e) LWR scaled model are 1.1×10^{9} Bq (0.03 Ci) from chemical processing of recycled uranium hexafluoride before it enters the isotope enrichment cascade and 7.4×10^{8} Bq (0.02 Ci) into the groundwater from a potential repository. The major risks from technetium-99 are from exposure of the gastrointestinal tract and kidney, although there is a small risk from exposure to the whole body. Applying the organ-specific dose weighting factors from 10 CFR 20.1003 to the gastrointestinal tract and kidney doses, the total-body 100-year dose commitment from technetium-99 to the whole body was estimated to be 4 person-Sv (400 person-rem) for the 1000-MW(e) LWR scaled model.

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses below about 100 mSv (10,000 mrem) and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), the BEIR VII report, supports the linear, no-threshold dose response model. Simply put, the theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Based on this model, the staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem)) from International Commission on Radiological Protection Publication 60 (ICRP 1991). This coefficient was multiplied by the sum of the estimated whole body population doses discussed above, approximately 66 person-Sv/yr (6600 person-rem/yr), to calculate that the U.S. population would incur a total of approximately 4.8 fatal cancers, nonfatal cancers, and severe hereditary effects annually. This risk is very small compared to the number of fatal cancers, nonfatal cancers, and severe hereditary effects that would be estimated to the U.S. population annually from exposure to natural sources of radiation using the same risk estimation method.

Radon releases from tailings are indistinguishable from background radiation levels at a few kilometers from the tailings pile (at less than 1 km in some cases) (NRC 1978). The public dose limit in the U.S. Environmental Protection Agency's (EPA's) regulation, 40 CFR 190.10(a), is 0.25 mSv/yr (25 mrem/yr) to the whole body from the entire fuel cycle, but most NRC licensees have airborne effluents resulting in doses of less than 0.01 mSv/yr (1 mrem/yr) (61 FR 65120).

In addition, at the request of the U.S. Congress, the National Cancer Institute conducted a study and published "Cancer in Populations Living Near Nuclear Facilities" in 1990 (NCI 1990). This report included an evaluation of health statistics around all nuclear power plants, as well as several other nuclear fuel cycle facilities, in operation in the United States in 1981 and found "no evidence that an excess occurrence of cancer has resulted from living near nuclear facilities" (NCI 1990). The contribution to the annual average dose received by an individual from the fuel-cycle related radiation and other sources as reported in the National Council on Radiation Protection and Measurements (NCRP) Report 93 (NCRP 1987) is listed in Table 6-2. The nuclear fuel cycle contribution to an individual's annual average radiation is extremely small (less than 0.01 mSv (1 mrem) per year).

Based on the analyses presented above, the staff concludes that the environmental impacts of radioactive effluents from the fuel cycle are small.

6.1.1.6 Radioactive Waste

The quantities of buried radioactive waste material (low-level, high-level, and transuranic wastes) are specified in Table S–3 (see Table 6-1). For low-level waste disposal at land burial facilities, the Commission notes in Table S–3 that there will be no significant radioactive

Table 6-2. Comparison of Annual Average Dose Received by an Individual from All Sources

Source	Dose (mSv/yr)[a]	Percent of Total
Natural		
Radon	2	55
Cosmic	0.27	8
Terrestrial	0.28	8
Internal (body)	0.39	11
Total natural sources	**3**	**82**
Artificial		
Medical x-ray	0.39	11
Nuclear medicine	0.14	4
Consumer products	0.10	3
Total artificial sources	**0.63**	**18**
Other		
Occupational	0.009	<0.30
Nuclear fuel cycle	<0.01	<0.03
Fallout	<0.01	<0.03
Miscellaneous sources	<0.01	<0.03

(a) Multiply millisievert (mSv)/yr by 100 to obtain millirem/yr.
Source: NCRP 1987

releases to the environment. For high-level and transuranic wastes, the Commission notes that these are to be buried at a repository, such as the candidate repository at Yucca Mountain, Nevada, and that no release to the environment is expected to be associated with such disposal, because it has been assumed that all of the gaseous and volatile radionuclides contained in the spent fuel are released to the atmosphere before the disposal of the waste. In NUREG-0116 (NRC 1976), which provides background and context for the high-level and transuranic Table S–3 values established by the Commission, the staff indicates that these high-level and transuranic wastes will be buried and will not be released to the environment.

On February 15, 2002, subsequent to receipt of a recommendation by Secretary Abraham, DOE, the President recommended the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and high-level nuclear waste (White House Press Release 2002).

The EPA developed Yucca Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000-year period (U.S. Court of Appeals 2004). The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63. In response to the Court's decision, EPA issued its proposed revised standards on August 22, 2005, that would revise the radiation protection standards for the candidate repository (70 FR 49014). In order to be consistent with EPA's revised standards, NRC proposed revisions to 10 CFR Part 63 on September 8, 2005 (70 FR 53313). The 10 CFR Part 63 rulemaking is titled "Implementation of a Dose Standard after 10,000 years," and the comment period was extended to December 7, 2005. The proposed standards are 0.15 mSv (15 mrem) per year for 10,000 years following disposal and 3.5 mSv (350 mrem) per year for 10,000 years through 1 million years after disposal. RIN 3150 will not be finalized by the time this EIS is issued.

Consequently at this time, for the high-level waste and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, the staff assumed that limits are developed along the line of the 1995 National Academy of Sciences report, *Technical Bases for Yucca Mountain Standards*, and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site, which would comply with such limits, with peak doses to virtually all individuals of 1 mSv (100 mrem) per year or less (NAS 1995; NRC 1996).

Despite any uncertainty with respect to these rules, some judgement as to National Environmental Policy Act of 1969 (NEPA) implications of offsite radiological impacts of spent fuel and high-level waste disposal should be made. For the reasons stated above, the staff concludes that the environmental impacts of radioactive waste disposal would be small.

6.1.1.7 Occupational Dose

In the review and evaluation of the environmental impacts of the fuel cycle, the staff considered the higher capacity factor in the PPE of 96 percent with a total net electric output of 3000 MW(e) for the ESP site (SERI 2005a). This case is referred to as the 1000-MW(e) LWR scaled model. The annual occupational dose attributable to all phases of the fuel cycle for the 1000-MW(e) LWR scaled model is about 24 person-Sv (2400 person-rem). This is based on a 6 person-Sv (600 person-rem) occupational dose estimate attributable to all phases of the fuel cycle for the model 1000 MW(e) LWR (NRC 1996). The environmental impact from this occupational dose is considered small because the dose to any individual worker is maintained within the dose limits of 10 CFR Part 20, which is 0.05 Sv/yr (5 rem/yr).

6.1.1.8 Transportation

The transportation dose to workers and the public totals about 0.025 person-Sv (2.5 person-rem) annually for the reference 1000-MW(e) LWR per Table S–3 (see Table 6-1).

This corresponds to a dose of 0.1 person-Sv (10 person-rem) for the 1000-MW(e) LWR scaled model. For comparative purposes, the estimated collective dose from natural background radiation to the population within 80 km (50 mi) of the Grand Gulf ESP site is 1020 person-Sv/yr (102,000 person-rem/yr). On this basis of this comparison, the staff concludes that environmental impacts of transportation would be small.

6.1.1.9 Conclusion

The staff evaluated the environmental impacts of the uranium fuel cycle as given in Table S–3 (see Table 6-1), considered the effects of radon-222 and technetium-99, and appropriately scaled the impacts for the 1000-MW(e) LWR scaled model. Based on this evaluation, the staff concludes that the impacts would be SMALL, and mitigation would not be warranted. The staff will verify the continued applicability of all assumptions should an applicant for a CP or COL reference the Grand Gulf ESP.

6.1.2 Gas-Cooled Reactors

As noted earlier, issues related to reactors based on non-LWR designs are not resolved because of the lack of information to validate values and impacts. However, the following analyses were performed using data from SERI for the purposes of estimation only.

The gas-cooled reactors analyzed for the uranium fuel cycle are:

- Gas Turbine Modular Helium Reactor (GT-MHR) – This reactor, developed by General Atomics, is a modular helium-cooled graphite-moderated reactor.

- Pebble Bed Modular Reactor (PBMR) – This reactor, developed by PBMR (Pty) Ltd., is a modular graphite-moderated helium-cooled gas turbine reactor.

Table S–3 from 10 CFR 51.51(a) can be used as a basis for bounding the environmental impacts from the uranium fuel cycle only for LWRs. SERI performed an assessment of the environmental impacts of the fuel cycle for gas-cooled reactor designs by comparing key parameters for these reactor designs to those used to generate the impacts in Table S–3 (SERI 2005a). Key parameters are energy usage, material involved, and number of shipments for each major fuel cycle activity (i.e., mining, milling, conversion, enrichment, fuel fabrication, and radioactive waste disposal). SERI sought to demonstrate in its environmental report that the impacts for the gas-cooled reactor designs were comparable to the environmental impacts identified in the technical basis document, WASH-1248, *Environmental Summary of the Uranium Fuel Cycle*, (AEC 1974) and its Supplement 1 (NUREG-0116) (NRC 1976) for Table S–3.

As discussed in Section 6.1.1, the fuel cycle impacts in Table S–3 (see Table 6-1) were based on a reference 1000-MW(e) LWR operating at an annual capacity factor of 80 percent for a net electric output of 800 MW(e). This is termed the "reference reactor year." For the purposes of evaluating fuel cycle impacts for the Grand Gulf ESP site, it was assumed that the additional LWR site-wide fuel impacts would be based on a total net electric output of 3000 MW(e) at 96 percent annual capacity factor. This was termed the 1000-MW(e) LWR scaled model and resulted in a factor about four times (i.e., 3000/800) the impacts in Table S–3.

One of the other-than-LWRs considered by SERI, the GT-MHR, is a four-module, 2400-MW(t), nominal 1140-MW(e) unit assumed to operate at an annual capacity factor of 88 percent for a net electric output of 1003 MW(e). Therefore, the maximum number of GT-MHR units that could be sited at the Grand Gulf ESP site and remain near or below the 3000 MW(e) total net electric output PPE for the site is three (i.e., 3 x 1003).

The second other-than-LWR considered by SERI, the PBMR, is an eight module, 3200-MW(t), nominal 1320-MW(e) unit assumed to operate at an annual capacity factor of 95 percent for a net electric output of 1253 MW(e). Therefore, the comparable number of PBMR units to remain below the 3000 MW(e) total net electric output PPE for the site is two (i.e., 2 x 1253).

SERI (2005a) compared the impacts in Table S–3 for LWRs with those of the gas-cooled reactor designs. The comparison used an annual fuel loading as a starting point and then proceeded in reverse direction through the fuel cycle (fuel fabrication, enrichment, conversion, milling, mining, radioactive waste). Table 6-3 provides an estimate of the impacts for each phase of the uranium fuel cycle assuming that the Grand Gulf ESP site would host three modular GT-MHR units or two modular PBMR units.

6.1.2.1 Fuel Fabrication

The quantity of UO_2 required for reactor fuel is a key parameter. The more UO_2 required, the greater the environmental impacts (meaning, more energy, greater emissions, and increased water usage). The 1000-MW(e) LWR scaled model described in Section 6.1.1 would require the equivalent of 160 MT of enriched UO_2 annually. This compares to 18 to 19 MT of enriched UO_2 annually for the gas-cooled reactor technologies (see Table 6-3).

GT-MHR fuel consists of microspheres of uranium oxycarbide coated with multiple layers of pryrocarbon and silicon carbide referred to as TRISO coating. Two types of microspheres are used in the GT-MHR fuel, one enriched to 19.8 percent uranium-235 and one with natural uranium. The microspheres and graphite shims are bound together into a rod-shaped compact, which is stacked into graphite blocks referred to as fuel elements. A reactor core consists of 1020 fuel elements.

Table 6-3. Fuel Cycle Environmental Impacts from Gas-Cooled Reactor Designs for the Grand Gulf Early Site Permit Site

Reactor Technology Facility/Activity	GT-MHR 4 Modules (2400 MW(t) total ≈1140 MW(e) total 88 percent capacity: multiplier=3)	PBMR 8 Modules (3200 MW(t) total ≈1320 MW(e) total 95 percent capacity: multiplier=2)
Mining Operations		
Annual ore supply (million MT)	1.01	1.01
Milling Operations		
Annual yellowcake (MT)	909	606
UF_6 Production		
Annual UF_6 (MT)	1137	758
Enrichment Operations		
Enriched UF_6 (MT)	24	25
Annual separative work units (MT)	612	388
Fuel Fabrication Plant Operations		
Enriched UO_2 (MT)	18	19
Annual fuel loading (MT Uranium)	16	17
Solid Radioactive Waste		
Annual low-level waste from reactor operations	3300 Ci[(a)]; 400 m^3	131 Ci; 2400 drums[(a)]
Low-level waste from reactor decontamination and decommissioning (Ci per reference reactor year)	Data not available	Data not available

(a) Multiply curies (Ci) by 3.7×10^{10} to obtain becquerel (Bq).

Notes:

- The enrichment separative work units (SWU) calculation was performed using the United States Enrichment Corporation, Inc. (USEC) SWU calculator and assumes a 0.30 percent tails assay.
- The information on the reference reactor (mining, milling, UF_6, enrichment, fuel fabrication values) was taken from NUREG-0116, Table 3.2, (NRC 1976) no recycling.
- The information on the reference reactor (solid radioactive waste) was taken from 10 CFR 51.51, Table S-3.
- The calculated information on the reference reactor uses the same methodology as for the reactor technologies.
- The normalized information is based on 1000 MW(e) and the reactor vendor-supplied unit capacity factor.
- For the new reactor technologies, the annual fuel loading was provided by the reactor vendor.
- The USEC SWU calculator also calculated the kgs of U feed. This number was multiplied by 1.48 to get the necessary amount of UF_6.
- The annual yellowcake number was generated using the relationship 2.61285 lb. of U_3O_8 to 1 kg U of UF_6; 1.185 kgs of U_3O_8 to 1.48 kg.
- The annual ore supply was generated assuming an 0.1 percent ore body and a 90 percent recovery efficiency.
- Co-60 with a 5.26 year half-life and Fe-55 with a 2.73 year half-life are the main nuclides listed for the PBMR decontamination and decommissioning waste.

Source: 10 CFR 51.51(b), Table S-3 Table of Uranium Fuel Cycle Environmental Data

PBMR fuel consists of UO_2 kernels (enriched to 12.9 percent uranium-235) that are TRISO-coated, similar to the GT-MHR fuel. The TRISO-coated particles are imbedded into a graphite matrix to form a fuel sphere that is 60 mm in diameter. Each fuel sphere contains approximately 15,000 TRISO-coated particles. Approximately 260,000 fuel spheres make up a core of a single reactor module.

The fuel described above for gas-cooled reactors is fabricated differently than fuel for LWRs. There are no currently operating large-scale fuel fabrication facilities producing gas-cooled reactor fuels in the United States; thus, a direct comparison of environmental impacts is not possible. Based on some environmental impacts from a small-scale fuel fabrication facility producing gas-cooled reactor fuel, SERI concluded that the environmental impacts from producing gas-cooled reactor fuel would be “not inconsistent” with those of LWRs (SERI 2005a). By comparison with the fuel fabrication impacts for LWR technologies, the staff concludes that the environmental impacts from producing gas-cooled reactor fuel likely would be small. However, these impacts would need to be assessed at the CP or COL stage, when the staff would consider the environmental data that are available on a large-scale, fuel-fabrication facility for gas-cooled reactors should an applicant select one of these designs.

6.1.2.2 Enrichment

SERI (2005a) identified two quantities of interest for enrichment. These were (1) the amount of energy required to enrich the fuel measured in separative work units (SWUs), and (2) the amount of UF_6 needed. A SWU is a measure of energy required to enrich the fuel. The major environmental impacts for the entire uranium fuel cycle are from the emissions of the fossil fuel plants used to supply energy for the gaseous diffusion plants that enrich the uranium. An enrichment technology developed since the impacts in Table S–3 (see Table 6-1) were developed and evaluated includes the gas centrifuge process that uses 90 percent less energy than the gaseous diffusion process (NRC 1996).

To produce 160 MT of enriched UO_2 for the 1000-MW(e) LWR scaled model, the enrichment plant needs to produce about 208 MT of UF_6, which requires approximately 500 MT of SWUs (SERI 2005a). For gas-cooled reactor technologies, the needed enriched UF_6 ranges from 24 to 25 MT of UF_6. The amount of energy to produce these quantities of enriched UF_6 for the gas-cooled reactor designs range from 388 to 612 MT of SWU. The upper range is up to 20 percent higher than the energy required for the reference LWR. SERI (2005a) concluded that the large reduction in energy associated with using an alternate enrichment technology (for example, centrifuge) and its associated environmental impacts would more than offset the increase in SWUs. The staff concludes that, on balance, the environmental impacts of enriching gas-cooled fuels by comparison with the impacts of enriching LWR fuel would likely be small. However, these impacts would need to be assessed at the CP or COL stage, when the staff would consider impacts from the enrichment technology in use at that time, should an applicant select one of these designs.

6.1.2.3 Uranium Hexafluoride Production – Conversion

There are two uranium conversion processes: a wet and a dry process. In the GEIS (NRC 1996), the NRC stated that environmental releases from the conversion facilities are small compared to the overall fuel cycle impacts and that changing from 100 percent use of one process to 100 percent use of the other would make no significant difference in the overall impacts. Similar conversion technologies would be used today to produce UF_6 as were considered when determining the environmental impacts that were part of Table S–3 of 10 CFR 51.51(a) (see Table 6-1).

The conversion facility would need to produce 1440 MT of UF_6 annually for the reference 1000-MW(e) LWR scaled model compared to 758 to 1137 MT of UF_6 for the gas-cooled reactors based on the SWU calculator (SERI 2005a); see Table 6-3, footnote (a) above. The other-than-LWR values are less than the amount of UF_6 required for the 1000-MW(e) LWR scaled model; therefore, the associated environmental impacts are expected to be less. On this basis, the staff concludes that the environmental impacts from producing UF_6 for gas-cooled reactors would be small.

6.1.2.4 Uranium Milling

Annual yellowcake (U_3O_8) production is the metric of interest for uranium milling. Plants requiring less yellowcake production than the reference plant would require less energy, have fewer emissions, and use less water.

The uranium mill for the 1000-MW(e) LWR scaled model would produce about 1200 MT of yellowcake. The uranium mill for the gas-cooled reactor technologies would need to produce 606 to 909 MT of yellowcake, which is less than the amount of yellowcake needed for the 1000 MW(e) LWR scaled model (SERI 2005a). On this basis, the staff concludes that the environmental impacts from uranium milling for the gas-cooled reactors would be small.

6.1.2.5 Uranium Mining

Annual ore supply is the metric of interest for uranium mining. The less ore mined, the smaller the environmental impacts (i.e., less energy used, fewer emissions, less water usage). For the 1000-MW(e) LWR scaled model, 1.09 million MT of raw ore would be required to produce 1200 MT of yellowcake. For the gas-cooled reactor technologies, the scaled ore requirements range from 0.67 to 1.01 million MT of ore, a range that is comparable to the amount of ore required for the reference 1000-MW(e) LWR scaled model. For this reason, the staff concludes that the environmental impacts from uranium mining for the gas-cooled reactors would be small.

6.1.2.6 Solid Low-Level Radioactive Waste – Operations

Table S–3 (see Table 6-1) of 10 CFR 51.51(a) states that there are 3.4×10^{14} Bq (9100 Ci) of low-level waste generated annually from operations of the reference LWR; the 1000-MW(e) LWR scaled model would result in 1.35×10^{15} Bq (36,400 Ci) of low-level waste annually. Gas-cooled reactor technologies are projected to generate 4.8×10^{12} Bq to 1.2×10^{14} Bq (131 to 3300 Ci) of low-level waste scaled annually, far below the amounts generated by the reference LWR (SERI 2005a). For this reason, the staff concludes that the environmental impacts from low-level radioactive waste operations for gas-cooled reactors would be small.

6.1.2.7 Solid Low-Level Radioactive Waste – Decontamination and Decommissioning

In Table S–3 (see Table 6-1), the Commission states that 5.6×10^{13} Bq (1500 Ci) per reference reactor year "...comes from reactor decontamination and decommissioning - buried at land burial facilities." SERI (2005a) noted that gas-cooled reactor technologies would (1) generate less waste than the reference 1000-MW(e) LWR, and (2) produce less heavy metal radioactive waste because of the higher thermal efficiency and higher fuel burnup. The gas-cooled reactor designs are also more compact than the reference LWR design, which would be expected to result in less decontamination and decommissioning waste (SERI 2005a). SERI concluded that low-level waste impact from decontamination and decommissioning will be comparable to or less than that of the reference LWR (SERI 2005a). On this basis, the staff concludes that the environmental impacts from solid low-level radioactive waste generated during decontamination and decommissioning for gas-cooled reactors would likely be small, but these impacts would need to be assessed again at the CP or COL stage if an applicant selects a gas-cooled design.

6.1.2.8 Conclusions

The staff expects that the environmental impacts from the uranium fuel cycle activities and solid waste management activities for the proposed gas-cooled reactors likely would be small. However, because of the uncertainty in the final design of the gas-cooled reactors and the change in technology that could be applied to uranium fuel cycle activities, this issue is not resolved. Should an applicant reference one of these designs, additional reviews would be needed at the CP or COL stage in the following areas: fuel fabrication, enrichment, and solid low-level waste operation during decontamination and decommissioning.

6.2 Transportation of Radioactive Materials

This section addresses both the radiological and nonradiological environmental impacts from normal operating and accident conditions resulting from (1) shipment of unirradiated fuel to new nuclear units at the Grand Gulf ESP site, (2) shipment of spent fuel to a monitored retrievable storage facility or a permanent repository, and (3) shipment of low-level radioactive waste and mixed waste to offsite disposal facilities. Distinctions between transportation impacts of advanced LWR designs and gas-cooled reactor designs are discussed.

The NRC evaluated the environmental effects of transportation of fuel and waste for light water nuclear power reactors in WASH-1238 (AEC 1972) and NUREG-75/038 (NRC 1975) and found the impact to be SMALL. These documents provided the basis for Table S–4 in 10 CFR 51.52, which summarizes the environmental impacts of transportation of fuel and waste to and from one LWR of 3000 to 5000 megawatts thermal (MW(t)) (1000 to 1500 MW(e)). Impacts are provided for normal conditions of transport and accidents in transport for a reference 1100-MW(e) LWR.

Dose to transportation workers during normal transportation operations was estimated to result in a collective dose of 0.04 person-Sv (4 person-rem) per reference reactor year. The combined dose to the public along the route and dose to onlookers were estimated to result in a collective dose of 0.03 person-Sv (3 person-rem) per reference reactor year. Environmental risks (radiological) during accident conditions were determined to be small. Nonradiological impacts during accident conditions were estimated as one fatal injury in 100 reference reactor years and one nonfatal injury in 10 reference reactor years. Subsequent reviews of transportation impacts in NUREG-0170 (NRC 1977a) and Sprung et al. (2000) concluded that impacts were bounded by Table S–4 of 10 CFR 51.52.

In accordance with 10 CFR 51.52(a), a full description and detailed analysis of transportation impacts is not required when licensing an LWR (i.e., impacts are assumed bounded by Table S–4) if an LWR meets the following criteria:

- The reactor has a core thermal power level not exceeding 3800 MW(t).

- Fuel is in the form of sintered UO_2 pellets having a uranium-235 enrichment not exceeding 4 percent by weight, and pellets are encapsulated in zirconium-clad fuel rods.

- Average level of irradiation of the fuel from the reactor does not exceed 33,000 MWd/MT, and no irradiated fuel assembly is shipped until at least 90 days after it is discharged from the reactor.

- With the exception of irradiated fuel, all radioactive waste shipped from the reactor is packaged and in solid form.

- Unirradiated fuel is shipped to the reactor by truck; irradiated fuel is shipped from the reactor by truck, rail, or barge; and radioactive waste other than irradiated fuel is shipped from the reactor by truck or rail.

The environmental impacts of the transportation of fuel and radioactive wastes to and from nuclear power facilities were resolved generically in 10 CFR 51.52, provided that the specific conditions in the rule (see above) are met; if not, then a full description and detailed analysis is required for initial licensing. Once licensed, the NRC may consider requests to operate at conditions above those in the facility's licensing basis, for example, higher burnups, enrichments, or thermal power levels above 33,000 MWd/MTU, 4 percent, and 3800 MW(t), respectively. Departures from the conditions itemized in 10 CFR 51.52(a) must be supported by a full description and detailed analysis of the environmental effects, as specified by 10 CFR 51.52(b).

SERI has not identified a specific reactor design for the Grand Gulf ESP site but used bounding parameters from seven reactor designs. Five of the designs are LWRs and include the ACR-700 (3964 MW(t)/unit); the ABWR (4300 MW(t)/unit); the surrogate AP1000 (3400 MW(t)/unit); the ESBWR (4000 MW(t)/unit), and the IRIS (3000 MW(t)/unit). For the ACR-700 reactor design, two reactors make up a unit. For the IRIS design, three reactors (modules) make up a unit. For the remaining LWR designs, one reactor makes up a unit.

None of the proposed LWR designs meet all the conditions in 10 CFR 51.52(a); therefore, a full description and detailed analysis are required for each LWR design. This conclusion is based on the following:

- ACR-700, ABWR, and ESBWR designs exceed the 3800-MW(t) core thermal power-level limit.

- ABWR, surrogate AP1000, ESBWR, and IRIS designs require fuel that exceeds the uranium-235 enrichment of 4 percent.

- ABWR, surrogate AP1000, ESBWR, and IRIS designs are expected to exceed the average irradiation level of 33,000 MWd/MTU.

The remaining two designs are gas-cooled reactors: the GT-MHR and the PBMR. Each GT-MHR unit is a four-module, 2400-MW(t), 1140-MW(e) gas-cooled reactor designed to operate at a unit capacity factor of 88 percent. Each PBMR is an eight-module, 3200-MW(t), 1320-MW(e) gas-cooled reactor designed to operate at a unit capacity factor of 96 percent. These compare to the reference reactor in WASH-1238 (AEC 1972), which is a single-unit, 1100-MW(e) LWR with a unit capacity factor of 80 percent. The gas-cooled reactor designs do not meet the conditions in 10 CFR 51.52(a) because these reactors are not LWR designs upon which Table S–4 impacts were based. Therefore, a full description and detailed analysis was required for each gas-cooled reactor design. This was provided by SERI in its response to a request for additional information on September 30, 2004 (SERI 2004f).

SERI used a sensitivity analysis to show that transportation impacts from advanced LWR designs would be bounded by the criteria identified in Table S–4 (SERI 2005a). The GEIS, Addendum 1 (NRC 1999) was referenced as the basis for exceeding 4 percent uranium-235 enrichment and 33,000 MWd/MTU. However, the GEIS, Addendum 1 applies to reactors that are listed in the GEIS, Appendix A, which does not address advanced reactors.

SERI also used a sensitivity analysis to show that transportation impacts from the advanced gas-cooled reactor designs would be bounded by the criteria identified in Table S–4 (SERI 2005a); however, as discussed previously, this type of analysis does not adequately meet the requirements of 10 CFR 51.52. SERI (2005a) identified the major contributors to transportation risk to be the number and type of shipment (shipment risk) and the kind of material being shipped (material risk). Its evaluation of shipment risk showed fewer shipments of unirradiated fuel, spent fuel, and low-level waste would be required for the advanced gas-cooled reactors compared to the reference LWR when averaged over 40 years of operation. Regarding material risk, SERI (2004f) concluded the following:

- The estimated total spent fuel radioactive inventory and fission product inventory was less for the gas-cooled reactors when compared to the reference LWR.

- Actinide inventories would be greater for the gas-cooled reactors (59 to 64 percent greater) because of the increased burnup for these types of reactors; however, because the GT-MHR was assumed to ship about one-third less spent fuel on a MTU basis, SERI (2005a) determined the actinide inventory per shipment would be about one-half of that in the reference LWR shipment. The PBMR is assumed to ship the same amount of spent fuel in a spent fuel shipping cask as the reference LWR so there is about a 60 percent increase in per-shipment actinide inventories from PBMR spent fuel shipments relative to the reference LWR.

- Gas-cooled reactors would generate fewer kilowatts of decay heat per MTU and fewer kilowatts of decay heat per truck cask at the time of shipment.

6.2.1 Transportation of Unirradiated Fuel

The staff performed an independent review of the environmental impacts of transporting unirradiated (fresh) fuel to the Grand Gulf ESP site. Environmental impacts of normal operating conditions and transportation accidents are discussed in this section. Appendix H provides the details of the analysis.

6.2.1.1 Normal Conditions

Normal conditions, sometimes referred to as “incident-free” transportation, are transportation activities in which shipments reach their destination without releasing any radioactive cargo to the environment. Impacts from these shipments would be from the low levels of radiation that penetrate the unirradiated fuel shipping casks.

Truck Shipments

Table 6-4 provides an estimate of the number of truck shipments of unirradiated fuel for each advanced reactor design compared to those of the reference 1100-MW(e) reactor specified in WASH-1238 (AEC 1972). Estimates are normalized for an equivalent 1100-MW(e) electric generating capacity. The basis for the shipment estimates can be found in Appendix H of this EIS. Only the ACR-700, PBMR, and GT-MHR reactor designs would exceed the number of truck shipments of unirradiated fuel estimated for the reference LWR in WASH-1238 (AEC 1972). The largest number of shipments, in excess of 700 shipments over 40 years, is for the GT-MHR. However, the combined annual shipments of unirradiated fuel, spent fuel, and radioactive waste equates to far less than the one truck shipment per day specified in Table S–4 of 10 CFR 51.52 for all reactor types.

Shipping Mode and Weight Limits

In 10 CFR 51.52(a), a condition is identified that states all unirradiated fuel be shipped to the reactor by truck. In information provided by SERI, SERI specifies that unirradiated fuel will be shipped to the reactor site by truck for all reactor designs that it references (INEEL 2003). In addition, 10 CFR 51.52(c) includes a condition that the truck shipments not exceed 33,100 kg (73,000 lbs), as governed by Federal or State gross vehicle weight restrictions. All the advanced reactor designs would meet this weight restriction for unirradiated fuel (INEEL 2003).

Table 6-4. Numbers of Truck Shipments of Unirradiated Fuel for Each Advanced Reactor Type

Reactor Type	Number of Shipments per Reactor Unit: Initial Core[(a)]	Annual Reload	Total[(b)]	Unit Electric Generation, MW(e)[(c)]	Capacity Factor[(c)]	Normalized, Shipments per 1100 MW(e)[(d,e)]
Reference LWR (WASH-1238)	18	6	252	1100	0.8	252
ABWR/ESBWR	30	6.1	267	1500	0.95	165
Surrogate AP1000	14	3.8	161	1150	0.95	130
ACR-700	30	15.4	628	1462[(f)]	0.9	420
IRIS	34	4.3	201	1005[(g)]	0.96	184
GT-MHR	51	20	831	1140[(h)]	0.88	729
PBMR	44	20	824	1320[(i)]	0.95	579

(a) Shipments of the initial core have been rounded up to the next highest whole number.
(b) Total shipments unirradiated fuel over a 40-year plant lifetime (i.e., initial core load plus 39 years of average annual reload quantities).
(c) Unit capacities and capacity factors were taken from INEEL (2003).
(d) Normalized to net electric output for WASH-1238 reference LWR; i.e., 1100-MW(e) plant at 80 percent or net electrical output of 880 MW(e).
(e) Ranges of capacities are given in INEEL (2003) for these unirradiated fuel shipments. The unirradiated fuel shipment data for these reactors were derived using the upper limit of the ranges.
(f) The ACR-700 unit includes two reactors at 731 MW(e) per reactor.
(g) The IRIS unit includes three reactors at 335 MW(e) per reactor.
(h) The GT-MHR unit includes four reactors at 285 MW(e) per reactor.
(i) The PBMR unit includes eight reactors at 165 MW(e) per reactor.
WASH-1238 = ACE 1972
Note: The reference LWR shipment values have all been normalized to 880-MW(e) net electrical generation.

Radiological Doses to Transport Workers and the Public

10 CFR 51.52, Table S–4, includes conditions related to radiological dose to transport workers and members of the public along transport routes. These doses are a function of many variables, including the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time in transit (including travel and stop times), and the number of shipments to which the individuals are exposed. For this EIS, the radiological dose impacts of the transportation of unirradiated fuel were calculated for the worker and the public using the RADTRAN 5 computer code (Neuhauser et al. 2003). Details of the calculations are found in Appendix H.

Table 6-5 presents the radiological impacts to workers, public onlookers (persons at stops and sharing the road), and members of the public along the route (i.e., residents within 800 m (0.5 mi) of the highway) for the advanced reactor designs. The cumulative annual dose estimates in Table 6-5 were normalized to 1100 MW(e). The NRC staff performed an independent review and determined that all dose estimates are bounded by the Table S–4 conditions of 0.04 person-Sv/yr (4 person-rem/yr) to transportation workers, 0.03 person-Sv/yr (3 person-rem/yr) to onlookers, and 0.03 person-Sv/yr (3 person-rem/yr) to members of the public along the route.

Table 6-5. Radiological Impacts of Transporting Unirradiated Fuel to Advanced Reactor Sites

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose, person-Sv/yr per 1100 MW(e)[(a)]		
		Workers	Public - Onlookers	Public - Along Route
Reference LWR (WASH-1238)	6.3	1.1×10^{-4}	4.2×10^{-4}	1.0×10^{-5}
ABWR/ESBWR	4.1	7.1×10^{-5}	2.7×10^{-4}	6.6×10^{-6}
Surrogate AP1000	3.3	5.6×10^{-5}	2.2×10^{-4}	5.2×10^{-6}
ACR-700	10.5	1.8×10^{-4}	7.0×10^{-4}	1.7×10^{-5}
IRIS	4.6	7.9×10^{-5}	3.1×10^{-4}	7.4×10^{-6}
GT-MHR	18.2	3.1×10^{-4}	1.2×10^{-3}	2.9×10^{-5}
PBMR	14.5	2.5×10^{-4}	9.6×10^{-4}	2.3×10^{-5}
10 CFR 51.52, Table S–4 Condition	<1 per day	4.0×10^{-2}	3.0×10^{-2}	3.0×10^{-2}

(a) Multiply person-sievert (Sv)/yr by 100 to obtain doses in person-rem/yr.
WASH-1238 = AEC 1972

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 100 mSv (10,000 mrem). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report (National Research Council 2006), the BEIR VII report, supports the linear, no-threshold dose response theory. Simply put, this theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Based on this model, the staff estimates the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem)) from International Commission on Radiological Protection Publication 60 (ICRP 1991). All the public doses presented in Table 6-5 are less than or equal to 0.0012 person-Sv/yr (0.12 person-rem/yr); therefore, the total detriment estimates associated with these doses would all be less than 1×10^{-4} fatal cancers, nonfatal cancers, and severe hereditary effects per year. These risks are very small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from exposure to natural sources of radiation.

Maximally Exposed Individuals Under Normal Transport Conditions

A scenario-based analysis was conducted to develop estimates of incident-free radiation doses to maximally exposed individuals (MEI). The analysis is based on information in DOE (2002) and incorporates information about exposure times, dose rates, and the number of times an individual may be exposed to an offsite shipment. Adjustments were made where necessary to reflect the fuel and waste shipments addressed in this EIS. In all cases, it was assumed that the dose rate emitted from the shipping containers is 0.1 mSv/hr (10 mrem/hr) at 2 m (6.6 ft) from the side of the transport vehicle, the maximum dose rate allowed by U.S. Department of Transportation regulations, even though unirradiated fuel and radioactive waste will have much lower dose rates than the regulations allow. An MEI is a person who may receive the highest radiation dose from a shipment to and/or from the advanced reactor site. The analysis is described below.

<u>Truck crew member</u>. Truck crew members would receive the highest radiation doses during incident-free transport because of their proximity to the loaded shipping container for an extended period of time. The analysis assumed that crew member doses are limited to 0.02 Sv (2 rem) per year, which is the DOE administrative control level (DOE 2002). This limit is anticipated to apply to spent nuclear fuel shipments to a disposal facility, as DOE will take title to the spent fuel at the reactor site. Spent nuclear fuel represents the bulk of the fuel and waste shipments to/from advanced reactor sites, and those with the highest radiation dose rates, so crew doses from unirradiated fuel and radioactive waste shipments will be lower than the spent nuclear fuel shipments. The NRC limit for occupational exposures is 0.05 Sv/yr (5 rem/yr).

<u>Inspectors</u>. Radioactive shipments are inspected by Federal or state vehicle inspectors, for example, at state ports of entry. DOE (2002) assumed that inspectors would be exposed for 1 hour at a distance of 1 m (3.3 ft) from the shipping containers. The dose rate at 1 m (3.3 ft) is about 0.14 mSv/hr (14 mrem/hr), so the dose per shipment is about 0.14 Sv (14 mrem). This is independent of the location of the advanced reactor site. Based on this conservative value, the annual doses to vehicle inspectors were calculated to be in the range of 9 to 18 mSv/yr (900 to 1800 mrem/yr), assuming the same person inspects all shipments of fuel and waste to and from

the advanced reactor sites. The high end of the range is the ACR-700 and the low end is the surrogate AP1000. All of the values are less than the 20 mSv/yr (2000 mrem/yr) administrative control level on individual doses.

Resident. The analysis assumed that a resident lives 30 m (100 ft) from the point where a shipment would pass and would be exposed to all shipments along a particular route. Exposures to residents on a per-shipment basis were extracted from RADTRAN 5 output files. These dose estimates are based on an individual located 30 m (100 ft) from the shipments that are traveling 24 km/hr (15 mph). The potential radiation doses to maximally-exposed residents, which are independent of the location of the advanced reactor site, ranged from about 0.00027 mSv/yr (0.027 mrem/yr) for the surrogate AP1000 to 0.00055 mSv/yr (0.055 mrem/yr) for the ACR-700.

Individual stuck in traffic. This scenario addresses potential traffic interruptions that could lead to a person being exposed to a loaded shipment for one hour at a distance of 1.2 m (4 ft). The analysis assumed this exposure scenario would occur only one time to any individual. The dose to the MEI was calculated in DOE (2002) to be 0.016 mSv (1.6 mrem).

Person at a truck service station. This scenario estimates doses to an employee at a service station where all truck shipments to/from the advanced reactors would stop. DOE (2002) assumed this person is exposed for 49 minutes at a distance of 16 m (52 ft) from the loaded shipping container. This results in a dose of about 0.0007 mSv/shipment (0.07 mrem/shipment) and an annual dose in the range from 0.044 mSv (4.4 mrem) for the surrogate AP1000 to 0.09 mSv/yr (9 mrem/yr) for the ACR-700.

6.2.1.2 Accidents

Accident risks are a combination of accident frequency and consequence. Accident frequencies for transportation of fuel to and from future reactors are expected to be lower than those used in the analysis in WASH-1238 (AEC 1972), which forms the basis for Table S–4 of 10 CFR 51.52, because of improvements in highway safety and security and an expected decrease in traffic accident, injury, and fatality rates. There is no significant difference in consequences of accidents severe enough to result in a release of unirradiated fuel particles to the environment between advanced LWRs and current-generation LWRs because the fuel form, cladding, and packaging are similar to those analyzed in WASH-1238. Consequently, the impacts of accidents during transport of unirradiated fuel for advanced LWRs to the Grand Gulf ESP site are expected to be smaller than the impacts listed in Table S–4 for current generation LWRs.

With respect to the advanced gas-cooled reactors, accident rates (accidents per unit distance) and associated accident frequencies (accidents per year) would be expected to follow the same trends as for LWRs (i.e., overall reduction relative to the accident rates used in the WASH-1238 analysis). The consequences of accidents involving gas-cooled reactor unirradiated fuel, however, are more uncertain. The staff assumed that the gas-cooled reactor unirradiated fuel shipments would have the same abilities as LWR unirradiated fuel to maintain functional integrity following a traffic accident. This assumption is considered to be conservative because gas-cooled reactor fuel operates at significantly higher temperatures, and thus maintains integrity under more severe thermal conditions than LWR fuel. Detailed information about the behavior of the gas-cooled reactor fuel under impact conditions was not available. However, packaging systems for unirradiated gas-cooled reactor fuel will need to meet the same performance requirements as unirradiated LWR fuel packages, including fissile material controls to prevent criticality during normal and accident conditions. Consequently, it is expected that packaging systems for unirradiated gas-cooled reactor fuels would provide equivalent protection to those designed for unirradiated LWR fuels. In addition, the fuel forms for the gas-cooled reactors are similar to those for LWRs (i.e., UO_2 for the PBMR and uranium oxycarbide for the GT-MHR versus UO_2 for LWRs) thus, the inherent failure resistance provided by unirradiated gas-cooled reactor fuels should be similar to that provided by LWRs. Based on the assumption that unirradiated gas-cooled and LWR fuels and associated packaging systems would provide similar resistance to various environmental conditions, the staff estimates that the impacts of accidents involving unirradiated gas-cooled reactor fuel likely would not be significantly different from impacts involving unirradiated LWR fuel and would be within the impacts listed in Table S–4 for current-generation LWRs. However, these impacts are not considered to be resolved, and would need to be assessed at the CP or COL stage when specific information is available regarding other-than-LWR fuel performance, if the applicant references such designs.

6.2.2 Transportation of Spent Fuel

The staff performed an independent review of the environmental impacts of transporting spent fuel from the proposed new nuclear unit or units at the Grand Gulf ESP site to a spent fuel disposal repository. The Yucca Mountain, Nevada, site is a possible location for a geologic repository. The staff considers that an estimate of the impacts of the transportation of spent fuel to a possible repository at Yucca Mountain, Nevada to be a reasonable bounding estimate of the transportation impacts to a storage or disposal facility because of the distances involved and the representativeness of the distribution of members of the public in urban, suburban, and rural areas (i.e., population distributions) along the shipping routes. Environmental impacts of normal operating conditions and transportation accidents are discussed in this section.

This analysis is based on shipment of spent fuel by legal-weight trucks in casks with characteristics similar to casks currently available (i.e., massive, heavily shielded, cylindrical metal pressure vessels). Each shipment is assumed to consist of a single shipping cask loaded on a modified trailer. These assumptions are consistent with assumptions made in the evaluation of the environmental impacts of transportation of spent fuel in Addendum 1 to the GEIS (NRC 1999). These assumptions are conservative because the alternative assumptions involve rail transportation or heavy-haul trucks, which would reduce the overall number of spent fuel shipments (NRC 1999).

Environmental impacts of transportation of spent fuel were calculated using the RADTRAN 5 computer code (Neuhauser et al. 2003). Routing and population data used in the RADTRAN 5 for truck shipments were obtained from the TRAGIS routing code (Johnson and Michelhaugh 2000). The population data in the TRAGIS code are based on the 2000 U.S. census.

The staff's evaluation reviewed the impacts of spent fuel shipments originating from the Grand Gulf ESP site and the alternative sites: James A. FitzPatrick Nuclear Power Plant and Pilgrim Nuclear Station. Another alternative site, River Bend Station, was considered by SERI in its environmental report, but was not evaluated by the staff because the route characteristics of distance and population would not be sufficiently different to produce results different from the Grand Gulf ESP site. Appendix H provides the details of the analysis.

6.2.2.1 Normal Conditions

Normal conditions, sometimes referred to as "incident-free" transportation, are transportation activities in which shipments reach their destination without an accident occurring en route. Impacts from these shipments would be from the low levels of radiation that penetrate the heavily shielded spent fuel shipping cask. Radiation exposure would occur to (1) persons residing along the transportation corridors between the Grand Gulf ESP site and the proposed repository; (2) persons in vehicles traveling on the same route as the spent fuel shipment; (3) persons at vehicle stops for vehicle inspections, refueling, and rest; and (4) transportation crew workers.

Shipping casks have not been designed for the advanced reactor designs. Information in INEEL (2003) indicated that advanced LWR fuel designs would not be significantly different from existing LWR designs; therefore, the characteristics of current shipping cask designs were used for the analysis for advanced LWR designs. No information is available on spent fuel shipping cask designs for the gas-cooled reactors. For purposes of this Chapter 6 analysis, their design was assumed to be the same as those used for the existing LWRs. Spent fuel shipping cask designs for gas-cooled reactors have not been defined and, therefore, impacts are not resolved. Impacts would be evaluated at the CP or COL stage if the applicant references such designs.

Radiation doses are a function of many parameters, including vehicle speed, traffic count, dose rate at 1 m from the vehicle, packaging dimensions, number of persons in the truck crew, stop time, and population density at stops. For a listing of the values for these and other parameters, refer to Appendix H. Table 6-6 presents radiation dose estimates to the transport workers and the public for the primary and alternative ESP sites. Doses are presented on a per-shipment basis. The per-shipment dose estimates are independent of reactor technology because they were calculated based on an assumed external radiation dose rate emitted from the cask, which was fixed at the regulatory maximum limit for the advanced reactor designs (i.e., 0.1 mSv/hr (10 mrem/hr) at 2 m).

Table 6-6. Routine (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from Potential Early Site Permit Sites to a Spent Fuel Disposal Facility

	Population Dose, person-Sv/shipment[(a)]		
Reactor Site	**Crew**	**Onlookers**	**Along Route**
Grand Gulf[(b)]	8.7×10^{-4}	2.8×10^{-3}	7.0×10^{-5}
FitzPatrick	9.8×10^{-4}	3.5×10^{-3}	9.5×10^{-5}
Pilgrim	1.1×10^{-3}	3.9×10^{-3}	1.2×10^{-4}

(a) Multiply person-sievert (Sv)/yr by 100 to obtain doses in person-rem/yr.
(b) Doses for the River Bend alternative site can be assumed to be bounded by the values for the proposed Grand Gulf ESP site because differences in route characteristics are minimal.

Population dose estimates per reactor year are presented in Table 6-7 for specific advanced reactor designs. Population doses were calculated by multiplying the number of spent fuel shipments per year for each advanced reactor design times the dose per shipment from Table 6-6. Population doses were normalized to the reference LWR design in WASH-1238 (880 net MW(e)) (AEC 1972). This corresponds to an 1100-MW(e) LWR operating at 80 percent capacity. Appendix H provides the basis upon which the number of spent fuel shipments was derived for each advanced reactor design.

The bounding cumulative doses to the exposed population given in Table S–4 (10 CFR 51.51(c)) are

- 0.04 person-Sv (4 person-rem) per reactor-year to transport workers
- 0.03 person-Sv (3 person-rem) per reactor-year to general public (onlookers) and members of the public along the route.

Population doses to the crew and the onlookers for all the reactor types, including the reference reactor designated in Table 6-7, exceed Table S–4 values. Two key reasons for the higher population doses relative to Table S–4 are the higher number of spent fuel shipments estimated for some of the reactor technologies and the longer shipping distances assumed for the analyses (i.e., to a possible repository in Nevada) than were used in WASH-1238. WASH-1238 used a "typical" distance for a spent fuel shipment of 1600 km (1000 mi), whereas the shipping distances used in this assessment ranged from about 3000 km (1800 mi) to 4700 km (2900 mi). The higher numbers of shipments are based on spent fuel shipping casks designed to transport shorter-cooled fuel (150 days out of the reactor). It was assumed in this Chapter 6 analysis that the shipping cask capacities are 0.5 MTU/shipment, roughly equivalent to one PWR or two BWR spent fuel assemblies per shipment.

Newer shipping cask designs are based on longer-cooled spent fuel (5 years out of reactor) and have larger capacities than those used in this assessment. DOE (2002) spent fuel shipping cask capacities were approximately 1.8 MTU/shipment, or up to four PWR or nine BWR fuel assemblies per shipment. Use of the newer shipping cask designs would reduce the number of spent fuel shipments and the associated environmental impacts. On balance, if the population doses are adjusted for the shipping distance and shipping cask capacity, the routine population doses from spent fuel shipments from all reactor types and all sites fall within Table S–4 requirements.

Other conservative assumptions in the staff's calculation include:

- <u>Use of the regulatory maximum dose rate (0.1 mSv/hr or 10 mrem/hr at 2 m) in the RADTRAN 5 calculations</u>. The shipping casks assumed in the EIS prepared in support of the application for a geologic repository at the proposed Yucca Mountain site (DOE 2002) were designed to transport spent fuel that has cooled for five years. In reality, most spent fuel will have cooled for much longer than five years before it is shipped to a possible geologic repository. Sprung et al. (2000) developed a probabilistic distribution of dose rates based on fuel cooling times that indicates that approximately three-fourths of the spent fuel to be transported to a possible geologic repository will have dose rates less than half of the regulatory limit. Consequently, the estimated population doses in Table 6-7 could be divided in half if more realistic dose rate projections are used.

- <u>Use of 30 minutes as the average time at a truck stop in the calculations</u>. Many stops made for actual spent fuel shipments are short-duration stops (e.g., 10 minutes) for brief visual inspections of the cargo (e.g., checking the cask tie-downs). These stops typically occur in minimally populated areas, such as an overpass or freeway ramp in an unpopulated area. Furthermore, empirical data provided in Griego et al. (1996) indicate that a 30-minute stop is toward the high end of the stop-time distribution. Average stop times observed by Griego et al. (1996) are on the order of 18 minutes. Based on these observations, it was concluded that the stop model assumptions used in this study overestimate public doses at stops by at least a factor of two. Consequently, the doses to onlookers given in Table 6-7 could be reduced by a factor of two to reflect more realistic truck shipping conditions.

Table 6-7. Routine (Incident-Free) Population Doses from Spent Fuel Transportation, Normalized to Reference Light Water Reactor

Reactor Type	Reference LWR (WASH-1238)			ABWR/ESBWR			Surrogate AP1000			ACR-700		
No Shipments per Year	60			41			40			90		
	Environmental Effects, person-Sv[(a)] per reference reactor year											
Reactor Site	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route
Grand Gulf	5.2×10^{-2}	1.7×10^{-1}	4.2×10^{-3}	3.5×10^{-2}	1.2×10^{-1}	2.8×10^{-3}	3.4×10^{-2}	1.1×10^{-1}	2.7×10^{-3}	7.8×10^{-2}	2.5×10^{-1}	6.2×10^{-3}
FitzPatrick	5.9×10^{-2}	2.1×10^{-1}	5.7×10^{-3}	4.0×10^{-2}	1.4×10^{-1}	3.9×10^{-3}	3.9×10^{-2}	1.4×10^{-1}	3.8×10^{-3}	8.8×10^{-2}	3.1×10^{-1}	8.5×10^{-3}
Pilgrim	6.5×10^{-2}	2.3×10^{-1}	7.0×10^{-3}	4.4×10^{-2}	1.6×10^{-1}	4.8×10^{-3}	4.3×10^{-2}	1.5×10^{-1}	4.6×10^{-3}	9.8×10^{-2}	3.5×10^{-1}	1.0×10^{-2}

Reactor Type	IRIS			GT-MHR			PBMR		
No Shipments per Year	35			34			12		
Environmental Effects, person-Sv[(a)] per reference reactor year									
Reactor Site	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route
Grand Gulf[(b)]	3.0×10^{-2}	9.8×10^{-2}	2.4×10^{-3}	2.9×10^{-2}	9.4×10^{-2}	2.3×10^{-3}	9.7×10^{-3}	3.2×10^{-2}	7.8×10^{-4}
FitzPatrick	3.4×10^{-2}	1.2×10^{-1}	3.3×10^{-3}	3.3×10^{-2}	1.2×10^{-1}	3.2×10^{-3}	1.1×10^{-2}	3.9×10^{-2}	1.1×10^{-3}
Pilgrim	3.8×10^{-2}	1.3×10^{-1}	4.0×10^{-3}	3.6×10^{-2}	1.3×10^{-1}	3.9×10^{-3}	1.2×10^{-2}	4.3×10^{-2}	1.3×10^{-3}

(a) Multiply person-sievert (Sv)/yr by 100 to obtain dose in mrem/yr.
(b) Doses for the River Bend alternative site can be assumed to be bounded by the values for the proposed Grand Gulf ESP site because differences in route characteristics are minimal.
WASH-1238 = AEC 1972

SERI performed its own RADTRAN 5 calculations looking at the impact of "incident-free" transport of spent fuel to a spent fuel disposal facility. The assumed transport of spent fuel originated from the Maine Yankee Nuclear Plant (a distance further than the Grand Gulf ESP site) and terminated at a disposal facility assumed to be at Yucca Mountain, Nevada. Dose estimates per shipment were similar to those calculated by the staff.

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 100 mSv (10,000 mrem), and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report (National Research Council 2006), the BEIR VII Report, supports the linear, no threshold dose response theory. Simply put, this theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Based on this model, the staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem)) from International Commission on Radiological Protection Publication 60 (ICRP 1991). All the population doses presented in Table 6-7 are less than one person-Sv/yr (100 person-rem/yr); therefore, the total detriment estimates associated with these population doses would all be less than 0.1 fatal cancers, nonfatal cancers, and severe hereditary effects per year. These risks are very small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from exposure to natural sources of radiation.

Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and wastes under normal conditions are presented in Section 6.2.1.1.

6.2.2.2 Accidents

As discussed previously, the staff used the RADTRAN 5 computer code to estimate impacts of transportation accidents involving spent fuel shipments. RADTRAN 5 considers a spectrum of potential transportation accidents, ranging from those with high frequencies and low consequences (e.g., "fender benders") to those with low frequencies and high consequences (i.e., accidents in which the shipping container is exposed to severe mechanical and thermal conditions). Details of the analysis are discussed in Appendix H.

Radionuclide inventories are important parameters in the calculation of accident risks. The radionuclide inventories used in this Chapter 6 analysis are from *Early Site Permit Environmental Report Sections and Supporting Documentation* (INEEL 2003). This report included hundreds of radionuclides for each advanced reactor type. A screening analysis was conducted to select the dominant contributors to accident risks to simplify the RADTRAN 5 calculations. The screening identified the radionuclides that would contribute more than 99.999 percent of the dose from inhalation of radionuclides released following a transportation accident. The dominant radionuclides are similar regardless of the fuel type (i.e., advanced LWR fuel or gas-cooled reactor fuel). Spent fuel inventories used in the staff analysis are presented in Table 6-8. Note that the list of radionuclides provided in the table includes all of the radionuclides that were included in the analysis conducted by Sprung et al. (2000), which validates the screening process used in this EIS. Also note that the INEEL (2003) analysis relied upon by SERI in its application did not provide radionuclide source terms for radioactive material deposited on the external surfaces of LWR spent fuel rods (commonly called “crud”). In addition, data on activation products was provided for only the advanced BWR. The advanced BWR spent fuel transportation risks were calculated assuming the entire cobalt-60 inventory is in the form of crud. This is very conservative as the source term because it is about two orders of magnitude greater than that given in Sprung et al. (2000). Because crud is deposited from corrosion products generated elsewhere in the reactor cooling system and the complete reactor design and operating parameters are uncertain, the quantities and characteristics of crud deposited on advanced reactor spent fuel are unknown at this time. Consequently, the impacts of crud and activation products on spent fuel transportation accident risks are not resolved and would need to be examined at the CP or COL stage. No radionuclide inventory data were presented in INEEL (2003) for the ACR-700 and IRIS advanced reactors. Because transportation accident risks were not quantified for these reactor types, these accident risks are not resolved and would need to be assessed at the CP or COL stage if the applicant references either of these designs.

Robust shipping casks are used to transport spent fuel because of the radiation shielding and accident resistance required by 10 CFR Part 71. Spent fuel shipping casks must be certified Type B packaging systems, which means the casks must withstand a series of severe postulated accident conditions with essentially no loss of containment or shielding capability. These casks are also designed with fissile material controls to ensure the spent fuel remains subcritical under normal and accident conditions. According to Sprung et al. (2000), the likelihood of encountering accident conditions that would lead to shipping cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents would result in no release of radioactive material from the shipping cask). The staff assumed that shipping casks for advanced reactor spent fuels will provide equivalent mechanical and thermal protection of the spent fuel cargo.

Table 6-8. Radionuclide Inventories Used in Transportation Accident Risk Calculations for Each Advanced Reactor Type, Bq/MTU[(a)]

Radionuclide	ABWR and ESBWR Inventory	Surrogate AP1000 Inventory	GT-MHR Inventory	PBMR Inventory
Am-241	4.96×10^{13}	2.69×10^{13}	8.18×10^{13}	7.55×10^{13}
Am-242m	1.24×10^{12}	4.85×10^{11}	5.03×10^{11}	8.51×10^{11}
Am-243	1.20×10^{12}	1.24×10^{12}	5.14×10^{11}	4.77×10^{12}
Ce-144	4.22×10^{14}	3.28×10^{14}	2.15×10^{15}	1.19×10^{15}
Cm-242	2.04×10^{12}	1.05×10^{12}	1.51×10^{12}	2.78×10^{12}
Cm-243	1.37×10^{12}	1.14×10^{12}	2.02×10^{11}	1.96×10^{12}
Cm-244	1.80×10^{14}	2.87×10^{14}	2.83×10^{13}	5.48×10^{14}
Cm-245	2.43×10^{10}	4.48×10^{10}	1.65×10^{8}	5.29×10^{10}
Co-60	1.01×10^{14}	(b)	(b)	(b)
Cs-134	1.78×10^{15}	1.78×10^{15}	2.21×10^{15}	4.03×10^{15}
Cs-137	4.59×10^{15}	3.44×10^{15}	1.08×10^{16}	1.41×10^{16}
Eu-154	3.81×10^{14}	3.38×10^{14}	3.23×10^{14}	3.74×10^{14}
Eu-155	1.93×10^{14}	1.71×10^{14}	8.77×10^{13}	1.08×10^{14}
Pm-147	1.25×10^{15}	6.51×10^{14}	6.92×10^{15}	5.07×10^{15}
Pu-238	2.27×10^{14}	2.25×10^{14}	1.17×10^{14}	4.55×10^{14}
Pu-239	1.43×10^{13}	9.44×10^{12}	2.25×10^{13}	1.11×10^{13}
Pu-240	2.28×10^{13}	2.01×10^{13}	3.96×10^{13}	3.32×10^{13}
Pu-241	4.51×10^{15}	2.58×10^{15}	8.33×10^{15}	7.18×10^{15}
Pu-242	8.29×10^{10}	6.73×10^{10}	1.56×10^{11}	4.51×10^{11}
Ru-106	6.07×10^{14}	5.74×10^{14}	1.48×10^{15}	1.68×10^{15}
Sb-125	1.99×10^{14}	1.42×10^{14}	2.21×10^{14}	2.51×10^{14}
Sr-90	3.27×10^{15}	2.29×10^{15}	8.95×10^{15}	1.08×10^{16}
Y-90	3.27×10^{15}	2.29×10^{15}	8.95×10^{15}	1.08×10^{16}

(a) Divide bequerel (Bq)/metric tons uranium (Bq/MTU) by 3.7×10^{10} to obtain curies/MTU.
(b) Cobalt-60 is an activation product. Only the ABWR and ESBWR reactor types identified in INEEL (2003) included inventory data for activation products.

The RADTRAN 5 accident risk calculations were performed using unit radionuclide inventories (Bq/MTU) for the spent fuel shipments from the various reactor types. The resulting risk estimates were then multiplied by assumed annual spent fuel shipments (MTU/yr) to derive estimates of the annual accident risks associated with spent fuel shipments from each potential advanced reactor site. As was done for routine exposures, the staff assumed that the numbers of shipments of spent fuel per year are equivalent to the annual discharge quantities.

For this assessment, release fractions for current-generation LWR fuels were used to approximate the impacts from the advanced reactor spent fuel shipments. This assumes that the fuel materials and containment systems (i.e., cladding, fuel coatings) behave similarly to current LWR fuel under applied mechanical and thermal conditions. Because of the lack of experimental data on gas-cooled reactor fuels, it is currently not known if this approach is bounding. However, gas-cooled reactors operate at much higher temperatures than LWRs; therefore, high temperature conditions anticipated in transportation accident fires should have less of an effect on radionuclide releases than they do for LWR fuels. Thus, smaller release fractions are anticipated for advanced gas-cooled reactor fuels than for LWR fuels subjected to thermal transients. However, this issue is not resolved because of the lack of information on these designs.

The NRC staff used RADTRAN 5 to calculate the population dose from the radioactive material released to the environment and assessed for four of five[a] possible exposure pathways. These pathways are:

(1) External dose from exposure to the passing cloud of radioactive material (cloudshine)

(2) External dose from the radionuclides deposited on the ground by the passing plume (groundshine). The staff's analysis included the radiation exposure from this pathway even though the area surrounding a potential accidental release would be evacuated and decontaminated, thus preventing long-term exposures from this pathway.

(3) Internal dose from inhalation of airborne radioactive contaminants (inhalation)

(4) Internal dose from resuspension of radioactive materials that were deposited on the ground (resuspension). The staff's analysis included the radiation exposures from this pathway even though evacuation and decontamination of the area surrounding a potential accidental release would prevent long-term exposures.

Table 6-9 presents the environmental consequences of transportation accidents when shipping spent fuel from the Grand Gulf ESP site and alternative sites to the proposed Yucca Mountain repository. The shipping distances and population distribution information for the routes were the same as those used for the normal "incident-free" conditions (for details, see Appendix H).

(a) Internal dose from ingestion of contaminated food was not considered as the staff assumed evacuation and subsequent interdiction of foodstuffs following a potential transportation accident.

| Table 6-9 presents estimates of population dose (person-Sv/ reactor year) for several of the advanced reactor designs. These values are normalized to the WASH-1238 reference reactor (880-MW(e) net electrical generation, 1100-MW(e) reactor operating at 80 percent capacity) | (AEC 1972).

Table 6-9. Annual Spent Fuel Transportation Accident Impacts for Advanced Reactors, Normalized to Reference 1000-MW(e) Light Water Reactor Net Electrical Generation

	Advanced Reactor Type			
	ABWR and ESBWR	Surrogate AP1000	GT-MHR	PBMR
MTU/yr	20.3	19.7	6.0	5.8
	Population Dose, person-Sv/per reference reactor year[(a)]			
Grand Gulf[(b)]	4.1×10^{-6}	3.7×10^{-7}	1.7×10^{-7}	2.7×10^{-7}
FitzPatrick	3.8×10^{-6}	3.3×10^{-7}	1.5×10^{-7}	2.5×10^{-7}
Pilgrim	8.1×10^{-6}	7.2×10^{-7}	3.3×10^{-7}	5.4×10^{-7}

(a) Multiply person-Sv/yr times 100 to obtain person-rem/yr.
(b) Doses for the River Bend alternative site can be assumed to be bounded by the values for the proposed Grand Gulf ESP site because differences in route characteristics are minimal.

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses below about 100 mSv (10,000 mrem) and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect, and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report (National Research Council 2006), the BEIR VII report, supports the linear, no-threshold dose response theory. Simply put, this theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Based on this model, the staff estimates the risk to the public from radiation exposure using the nominal probability coefficient for total detriment – 730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem) – from International Commission on Radiological Protection Publication 60 (ICRP 1991). All the population doses presented in Table 6-9 are less than 1.0×10^{-5} person-Sv (1.0×10^{-3} person-rem) per reference reactor year; therefore, the total detriment estimates associated with these population doses would all be less than 1.0×10^{-6} fatal cancers, nonfatal cancers, and severe hereditary effects per reference reactor year. These risks are quite small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from exposure to natural sources of radiation.

6.2.2.3 Conclusion

The values determined by this analysis represent the contribution of such effects to the environmental costs of licensing the reactor. Because of the conservative approaches and data used to calculate doses, actual environmental effects are not likely to exceed those calculated in the EIS. Thus, the staff concludes that the overall transportation accident risks associated with advanced LWR reactor spent fuel shipments are SMALL and are consistent with the risks associated with transportation of spent fuel from current-generation reactors presented in Table S–4 of 10 CFR 51.52. The fuel performance characteristics, shipping casks, and accident risks for other-than-LWR designs are not resolved and would need to be assessed at the CP or COL stage if the applicant references such designs.

6.2.3 Transportation of Radioactive Waste

This section discusses the environmental effects of transporting waste from advanced reactor sites. The environmental conditions listed in 10 CFR 51.52(a) that apply to shipments of radioactive waste include the following:

- Radioactive waste (except spent fuel) is packaged in solid form.
- Radioactive waste (except spent fuel) is shipped from the reactor by truck or rail.
- The weight limitation is 33,100 kg (73,000 lb) per truck and 90,700 kg (100 tons) per cask per railcar.
- The traffic density limitation is less than one truck shipment per day or three railcars per month.

In INEEL (2003), it is stated that all the radioactive waste will be transported by truck. SERI plans to solidify and package its waste regardless of which advanced reactor technology it chooses. In addition, waste from any of the advanced reactor technologies will be subject to NRC (10 CFR Part 71) and U.S. Department of Transportation (49 CFR Parts 171, 172, 173, and 178) regulations for the shipment of radioactive material. Radioactive waste from any of the advanced reactor technologies are expected to be capable of being shipped in compliance with Federal or State weight restrictions.

Table 6-10 presents estimates of annual waste volumes and annual waste shipment numbers for the advanced reactor types normalized to the reference 1100-MW(e) LWR defined in WASH-1238 (AEC 1972). Annual waste volumes and waste shipments for the advanced reactor technologies were less than the 1100-MW(e) reference reactor that was the basis for Table S–4 for all designs except the PBMR.

Table 6-10. Summary of Radioactive Waste Shipments for Advanced Reactors

Reactor Type	INEEL (2003) Waste Generation Information	Annual Waste Volume, m^3/yr per unit	Electrical Output, MW(e) per unit	Normalized Rate, m^3/1100 MW(e) reactor (880 MW(e) net)[(a)]	Shipments/ 1100 MW(e) (880 MW(e) net) Electrical Output[(b)]
Reference LWR (WASH-1238)	100 m^3/yr per unit	108	1100	108	46
ABWR	100 m^3/yr per unit	100	1500	62	27
ESBWR	100 m^3/yr per unit	100	1500	62	27
Surrogate AP1000	55 m^3/yr per unit	56	1150	45	20
ACR-700	47.5 m^3/yr per unit	95	1462[(c)]	64	28
IRIS	25 m^3/yr per unit	74 (3 units)	1005[(d)]	67	29
GT-MHR	98 m^3/yr (4 unit plant)	98 (4 units)	1140[(e)]	86	37[(g)]
PBMR	100 drums/yr per unit	168 (8 units)	1320[(f)]	118	51[(g)]

(a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are given in Table 6-3 for each reactor type. All are normalized to 880-MW(e) net electrical output (1100-MW(e) plant with an 80-percent capacity factor).
(b) The number of shipments per 1100 MW(e) was calculated assuming the WASH-1238 average waste shipment capacity of 2.34 m^3 per shipment (108 m^3/yr divided by 46 shipments/yr).
(c) The ACR-700 unit includes two reactors at 731 MW(e) per reactor.
(d) The IRIS unit includes three reactors at 335 MW(e) per reactor.
(e) The GT-MHR unit includes four reactors at 285 MW(e) per reactor.
(f) The PBMR unit includes eight reactors at 165 MW(e) per reactor.
(g) SERI states in INEEL (2003) that 90 percent of the waste could be shipped on trucks carrying 28 m^3 (1000 ft^3) of waste and the remaining 10 percent in shipments carrying 5.7 m^3 (200 ft^3) of radioactive waste. This would result in five to six shipments per year after normalization to the reference LWR electrical output.
Conversions: 1 m^3 = 35.31 ft^3, drum volume = 210 liters (0.21 m^3)
WASH-1238 = AEC 1972

As shown in the table, only the PBMR would be expected to generate a larger volume of radioactive waste than the reference LWR in WASH-1238 (AEC 1972). However, the GT-MHR and PBMR information in INEEL (2003) assumed that the applicant would ship wastes using two different packaging systems: one that hauls 28 m^3 per shipment (1000 ft^3 per shipment) and one that hauls 5.7 m^3 per shipment (200 ft^3 per shipment). Under those conditions, the number of shipments of radioactive waste per year, normalized to 1100 MW(e) electric generation capacity, would be about six shipments per year per 1100 MW(e) (880 net MW(e)) for the GT-MHR and seven shipments per year per 1100 MW(e) for the PBMR. These estimates are well below the reference LWR (46 shipments per year per 1100 MW(e)). However, impacts from other than LWR designs are not resolved because of the lack of verifiable information.

The sum of the daily shipments of unirradiated fuel, spent fuel, and radioactive waste is well below the one truck shipment per day condition given in 10 CFR 51.52, Table S–4 for all reactor types. Doubling the shipment estimates to account for empty return shipments of fuel and waste is still well below the one-truck-shipment-per-day condition.

Dose estimates to the maximally-exposed individual from transport of unirradiated fuel, spent fuel, and waste under normal conditions are presented in Section 6.2.1.1.

6.2.4 Conclusions

An analysis was conducted of the impacts under normal operating and accident conditions of transporting unirradiated fuel to advanced reactor sites and spent fuel and wastes from advanced reactor sites to disposal facilities. To make comparisons to Table S–4, the environmental impacts are normalized to a reference reactor year. The reference reactor is an 1100-MW(e) reactor that has an 80-percent capacity factor, for a total electrical output of 880 MW(e) per year. The environmental impacts can be adjusted to calculate impacts per site by multiplying the normalized impacts by the ratio of the total electric output for the advanced reactor sites to the electric output of the reference reactor.

Because of the conservative approaches and data used to calculate doses, actual environmental effects are not likely to exceed those calculated in the EIS. Thus, the staff concludes that the environmental impacts of transportation of fuel and radioactive wastes to and from advanced LWR designs would be SMALL, and would be consistent with the risks associated with transportation of fuel and radioactive wastes from current-generation reactors presented in Table S–4 of 10 CFR 51.52. For gas-cooled designs, the impacts are likely to be small, but this issue is not resolved because of the lack of verifiable information on these designs. At the CP or COL stage, an applicant referencing these designs would need to provide the necessary data and the staff would need to validate the assumptions used in this transportation analysis.

Assumptions that will need validation if a gas-cooled is selected include:

- Verifying that unirradiated and spent fuel from gas-cooled reactors have the same abilities as LWR unirradiated and spent fuel to maintain fuel and cladding integrity following a traffic accident.

- Verifying that shipping cask design assumptions (for example, cask capacities) are equal to or bounded by the assumptions in this analysis.

- Verifying that unirradiated fuel initial core/refueling requirement, spent fuel generation rates, and radioactive waste generation rate assumptions are equal to or bounded by the assumptions in this analysis.

- Verifying that shipping cask capacities and accident source terms, including spent fuel inventories, severity fractions, and release fractions, are equal to or bounded by the assumptions in this analysis.

Should the ACR-700 or IRIS reactors be chosen for the ESP site, a transportation accident analysis will be performed as spent fuel inventories were not available for this analysis.

6.3 Decommissioning Impacts

At the end of the operating life of a power reactor, the NRC regulations require that the facility undergo decommissioning. Decommissioning is the removal of a facility safely from service and the reduction of residual radioactivity to a level that permits termination of the NRC license. The regulations governing decommissioning of power reactors are found in 10 CFR 50.75 and 50.82.

Environmental impacts from the activities associated with the decommissioning of any LWR before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, *Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586, (NRC 2002). If an applicant for a CP or COL referencing the Grand Gulf ESP applies for a license to operate one or more additional units at the Grand Gulf ESP site, there is a requirement to provide a report containing a certification that financial assurance for radiological decommissioning will be provided. At the time an application is submitted, the requirements in 10 CFR 50.33, 50.75, and 52.77 (and any other applicable requirements) would have to be met.

At the ESP stage, applicants are not required to submit information regarding the process of decommissioning, such as the method chosen for decommissioning, the schedule, or any other aspect of planning for decommissioning. SERI did not provide this information in its application.

For the new nuclear unit or units, if LWR designs are chosen or if other-than-LWRs that were considered in NUREG-0586, Supplement 1 are chosen, the impacts from decommissioning are expected to be within the bounds described in NUREG-0586, Supplement 1. In such cases, the staff expects the impact from decommissioning are likely to be small. However, for whatever design that is selected, the impacts from decommissioning are not resolved and would have to be assessed at the CP or COL stage.

6.4 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

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."

10 CFR Part 63. Code of Federal Regulations, Title 10, *Energy*, Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

10 CFR Part 71. Code of Federal Regulations, Title 10, *Energy*, Part 71, "Packaging and Transportation of Radioactive Material."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

49 CFR Part 171. Code of Federal Regulations, Title 49, *Transportation*, Part 171, "General Information, Regulations, and Definitions."

49 CFR Part 172. Code of Federal Regulations, Title 49, *Transportation*, Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements."

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7.0 Cumulative Impacts

The staff considered the potential cumulative impacts of constructing and operating one or more nuclear power units at the proposed Grand Gulf early site permit (ESP) site. For purposes of the analysis in Chapter 7, past actions were those related to the existing Grand Gulf Nuclear Station (GGNS). Present actions are those related to the resources at the time of the ESP application until the start of construction. Future actions are those that are reasonably foreseeable through construction and operation of the Grand Gulf ESP unit or units, including decommissioning. The geographical area over which past, present, and future actions could contribute to cumulative impacts depends on the type of action considered and is described below for each impact area.

The impacts of the proposed action, as described in Chapters 4 and 5, are combined with other past, present, and reasonably foreseeable future actions in the vicinity of the Grand Gulf ESP site that would affect the same resources impacted by the current GGNS regardless of what agency (Federal or non-Federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in Title 40 of the Code of Federal Regulations (CFR) 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important it if contributes to or accelerates the overall resource decline. For issues considered to be resolved, the staff will verify the continued applicability of all assumptions should an applicant for a construction permit or a combined license reference the Grand Gulf ESP.

For some issues related to the construction and operation of a proposed ESP nuclear unit, there was not sufficient information to allow the staff to evaluate the impacts. These issues are not resolved and an evaluation of cumulative impacts for these issues cannot be completed until additional information is provided by an applicant for a construction permit (CP) or a combined license (COL) that references an ESP for the Grand Gulf ESP site.

7.1 Land Use

For the purpose of this analysis, the geographic area considered for cumulative impacts to land use resulting from construction and operation of the proposed Grand Gulf ESP facility encompasses Claiborne County, Mississippi.

The staff reviewed the available information on the impacts on land use of constructing one or more additional nuclear units at the Grand Gulf ESP site. Cumulative impacts for land use include possible additional growth and land conversions to accommodate new workers and services. However, the impacts are expected to be minor as the construction work force and the operations work force are expected to be drawn from an area much wider than Claiborne County, to include the larger cities of Vicksburg, Natchez, and Jackson, Mississippi. Because the work force will be dispersed over these larger cities in the labor supply region, the induced impacts on land use (resulting from either construction or operations of one or more new units at the Grand Gulf ESP site) can be easily absorbed in that wider region. However information on transmission line improvements and associated changes in rights-of-way was not available at the ESP stage. Consequently, this issue is not considered to be resolved.

7.2 Air Quality

The Grand Gulf ESP site is in an area that is in attainment for criteria pollutants. Construction activities at the site may reduce air quality if unmitigated. However, SERI has included mitigation measures to minimize the impact of construction activities on air quality in its environmental report (SERI 2005). Considering the limited duration of construction activities and the mitigation measures described by SERI, the staff concludes that the impacts of construction activities on air quality would be small. Given this conclusion and the current air quality, the staff concludes the cumulative impacts of construction activities would be SMALL, and additional mitigation would not be warranted.

Operation of new nuclear units at the Grand Gulf ESP site would result in increases in some pollutant emissions at the site. Emissions for each unit would be approximately the same as the emissions for the existing GGNS. However, because of the magnitude and intermittent nature of the emissions, the staff concludes that the impacts of operation of new nuclear units at the Grand Gulf ESP site would be SMALL. These same factors lead the staff to conclude that the cumulative impacts of the operation of one or more new units and the existing unit on air quality would be SMALL, and additional mitigation would not be warranted.

Heat, water vapor, and drift plumes from cooling towers associated with operation of new nuclear units at the Grand Gulf ESP site may, on occasion, merge with the plumes from the existing GGNS cooling tower. The staff considers it unlikely that the impacts of the merged plumes on air quality would be significantly different from the impacts of the plume from the GGNS cooling tower. The staff concludes that the air quality impacts of cooling towers for one or more new nuclear units at the Grand Gulf ESP site would be SMALL. The staff also concludes the cumulative impacts on air quality of plumes from the cooling towers would be SMALL, and additional mitigation would not be warranted.

7.3 Water Use and Quality

The assessments performed by the staff and described in Sections 4.3 and 5.3 related to impacts of construction and operation of the proposed Grand Gulf ESP facility explicitly considered the cumulative impacts of the existing GGNS facility. For instance, the CORMIX model assessment described in Section 5.3.2 was used to estimate the combined discharges of the existing GGNS facility and the proposed ESP facility. By assuming steady-state conditions at a distant future state, the staff adopted a conservative approach to processes that may change incrementally over time. For instance, groundwater drawdown considerations reflected the steady-state drawdown based on population projections well into the future.

7.3.1 Surface Water Use

The watersheds contributing flow to the two streams in the Grand Gulf ESP site are nearly contained within the proposed ESP site, and the remaining drainage area outside the ESP site area would not be expected to change significantly. Therefore, changes in surface water supply outside the site would not alter the surface water conditions of the site's two streams.

Even with alterations in climate patterns and further demands for water upstream of the Grand Gulf ESP site, the Mississippi River is expected to remain the largest and most significant waterway in the United States. Continued regulation of the flow and management of the shoreline by the U.S. Army Corps of Engineers is expected to preserve the course and flow of the Mississippi. No activity at the Grand Gulf ESP site by itself, nor other activities outside the site, would be expected to alter fundamentally the character of the Mississippi River.

Based on the above, the staff concludes that the cumulative impacts of surface water use at the Grand Gulf ESP site would be SMALL, and additional mitigation would not be warranted.

7.3.2 Groundwater Use

The staff found that the information provided by SERI (2005) was not adequate to reliably assess the potential incremental drawdown of the groundwater elevation associated with groundwater wells proposed in the Catahoula formation for the Grand Gulf ESP facility. Consequently, this issue is not resolved. An applicant for a construction permit or combined license referencing the ESP for the Grand Gulf ESP site would be required to provide additional information on the suitability of the Catahoula formation as a source for such water.

7.3.3 Surface Water Quality

As noted above, the watersheds contributing flow to the two streams in the Grand Gulf ESP site are nearly contained within the ESP site, and the land use of the remaining drainage area outside the site would not be expected to change significantly. Therefore, changes in surface water quality outside the site would not alter the surface water quality of the site's two streams.

The Mississippi River is such a critical national resource that efforts to preserve or improve its quality are expected. Activities at the Grand Gulf ESP site would not fundamentally alter the quality of the Mississippi River because of its vast flow. However, information on the chemical discharges from the proposed facility are unavailable at the ESP stage. Consequently, this issue is not resolved.

7.3.4 Groundwater Quality

The Catahoula aquifer has been identified by the U.S. Environmental Protection Agency Administrator as a sole-source aquifer (EPA 1998). As such, activities over the Catahoula are receiving special attention to protect its quality. The staff identified a range of impacts on groundwater quality that could result, based on available information. Consequently, this issue is not resolved.

7.4 Terrestrial Ecosystem

Construction and operation of one or more new units at the Grand Gulf ESP site were evaluated to determine the magnitude of their contribution to regional cumulative adverse impacts on terrestrial ecological resources. Determinations for construction were made for important terrestrial species (animal and plant) and habitats (as defined in NRC 2000) by evaluating the effect of construction in light of other past, present, and future actions in the region. Determinations for operation were made for resource attributes normally affected by cooling tower operation, transmission line operation, and right-of-way maintenance. For this analysis, the geographic region encompassing past, present, and foreseeable future actions is the area immediately surrounding the Grand Gulf site, including adjoining sections of the Mississippi River bottomland and loess bluffs to the north and south and west into Louisiana, and the area surrounding the existing GGNS Unit 1 transmission line rights-of-way.

The area around the Grand Gulf site and GGNS Unit 1 transmission line rights-of-way is rural. Land cover currently consists primarily of upland and bottomland hardwood forests and secondarily of agricultural fields and pasture. Because agriculture is not the primary land use in the area, this area likely has incurred only relatively minor losses of terrestrial plant and animal species and habitats during agricultural conversion, which means most of the species affected likely still occur in neighboring forested areas. For example, the area is known to have been used historically by the Louisiana black bear (*Ursus americanus luteolus*), a Federally threatened species. The Louisiana black bear may have been observed on and near the Grand Gulf site and could occur on the site and in the vicinity. Construction could destroy or displace bears and reduce the suitability of habitat (for example, via fragmentation) or preclude it from future use (for example, via replacement with facilities). This possibility appears greatest in the bottomland area (along the Mississippi River) of the Grand Gulf ESP site, the portion of the site most likely to be used by bears. However, such an impact would be unlikely, given the relatively small amount of bottomland forested wetland that would be disturbed.

Construction of the proposed unit or units at the Grand Gulf ESP site would disturb 22 ha (55 ac) of bottomland hardwood forest and 59 ha (145 ac) of upland hardwood forest for permanent structures and facilities and equipment staging and borrow areas. In addition, an undetermined amount of mostly upland hardwood forest could also be disturbed by construction for transmission system improvements such as the addition of new transmission lines (see Section 4.1.2). If construction for the addition of new transmission lines occurred entirely within the existing rights-of-way (see Section 4.1.2), the overall contribution of construction of the proposed Grand Gulf ESP facility to cumulative losses of important species (including the Louisiana black bear) and habitats in the region would be SMALL. However, if construction for the addition of new transmission lines required doubling the width of the existing rights-of-way or creation of one or more new rights-of-way (see Section 4.1.2), the overall contribution of construction of the proposed Grand Gulf ESP facility to cumulative losses of important species and habitats in the region would be MODERATE. During the review for this ESP application, no other present or future actions in the region were identified that could significantly affect terrestrial species or habitats.

During the review of the SERI ESP application, no other past, present, or future actions in the region were identified that could significantly affect wildlife and wildlife habitat in ways similar to those associated with Grand Gulf ESP facility cooling tower operation (cooling tower noise; adverse effect on crops, ornamental vegetation, and native plants from cooling tower salt drift; and birds colliding with cooling towers). Thus, because these impacts were considered negligible for the Grand Gulf ESP facility, the cumulative adverse impact of these types of activities in the region would also be considered minor. Consequently, the staff concludes that the contribution of Grand Gulf ESP facility cooling tower operation to cumulative impacts on wildlife and wildlife habitat in the region would be negligible.

During the review of the SERI ESP application, no other past, present, or future actions in the region were identified that could significantly affect wildlife and wildlife habitat in ways similar to those associated with Grand Gulf ESP facility transmission line operation and right-of-way maintenance (birds colliding with transmission lines; flora and fauna affected by electromagnetic fields and right-of-way maintenance; and floodplains and wetlands affected by right-of-way maintenance). Thus, because these impacts were considered negligible for the Grand Gulf ESP facility, the cumulative adverse impacts of these types of activities in the region would also be minor. Consequently, the staff concludes that the contribution of the operation of transmission lines and the maintenance of transmission line rights-of-way to cumulative impacts on wildlife and wildlife habitat in the region would be negligible.

In summary, the need for new transmission lines and selection of one or more routes has not been established at this time. An analysis would be conducted by the transmission and distribution system owner and operator under the regulatory process described in Section 4.1.2 prior to or during the CP or COL phase. Therefore, the staff concludes that the contribution of construction of the Grand Gulf ESP facility to cumulative impacts on terrestrial ecological resources in the region is unresolved.

The staff also concludes that the contribution of operation (including cooling tower operation and operation of the upgraded GGNS Unit 1 transmission lines and maintenance of the associated expanded transmission line rights-of-way) and eventual decommissioning of the facility to cumulative impacts on terrestrial ecological resources in the region would be SMALL, and additional mitigation would not be warranted.

7.5 Aquatic Ecosystem

The staff evaluated the magnitude of impacts on regional aquatic ecological resources from construction and operation of one or more new units at the Grand Gulf ESP site. Determinations for construction were made for the generic categories of important aquatic species (animal and plant) and habitats (as defined by NRC 2000) by evaluating the effect of construction in light of other past, present, and future actions in the region. Determinations for operation were made for resource attributes normally affected by the cooling water system. This includes an evaluation of the potential effect of water intake, consumption, and discharge. For this Chapter 7 analysis, the geographic region encompassing past, present, and foreseeable future actions is the area immediately surrounding the Grand Gulf ESP site, including adjoining sections of the Mississippi River and the area surrounding the existing GGNS Unit 1 and transmission line rights-of-way.

From an aquatic ecological perspective, the construction of GGNS Unit 1 in the 1970s did not change the Mississippi River significantly. The construction of radial wells, which collect makeup water by extracting groundwater near the river shoreline, and the discharge structure only caused temporary disruption of the shoreline habitat. While pre-construction surveys indicated that organisms living in the shoreline habitat were few, the stabilization of the banks with concrete mats (completed by the late 1970s along the entire reach of the river in the vicinity of the Grand Gulf site) further limited habitat for benthic organisms in the shoreline region. Few other changes have affected the river habitat since the construction of GGNS Unit 1, outside of the occasional dredging activities.

Construction related to the Grand Gulf ESP facility intake and discharge systems would have minimal and temporary impacts on aquatic organisms. No species of special interest or Federally or State-listed threatened and endangered species are expected to be affected by construction activities. The staff concludes the overall contribution of construction to cumulative losses of aquatic organisms in the region would be minor, and no further mitigation would be needed beyond that identified in Section 4.4.2.

The staff considered the potential cumulative impacts related to water use and to impingement and entrainment of aquatic organisms. GGNS Unit 1 uses radial wells, which do not impinge or entrain aquatic organisms. Operation of the proposed ESP facility intake structure would lead to some future impingement and entrainment of aquatic organisms. Future actions for this analysis are considered to be those for operation of the proposed facility through a complete license term and the time for the licensee to complete decommissioning of the new nuclear unit or units.

SERI's current plans include the use of an intake structure that is of similar design to the ones used at River Bend Station. The location of the intake structure near the entrance of the embayment and off the bottom of the river would likely decrease impingement by removing the structure from areas with a higher concentration of fish. The water consumed for the proposed facility would be approximately 0.2 percent of the flow of the river at extreme low-flow conditions. The intake screens would be sized so the average intake through the screen would have a flow velocity of less than or equal to 0.15 m/s (0.5 ft/s). Based on these design plans, impingement and entrainment during operation of the proposed facility would be minimal.

Operation of the proposed intake structure would not be expected to affect species of special interest or Federally or State-listed threatened and endangered species. Decommissioning of the proposed facility would result in the cessation of water consumption from the river and the impingement and entrainment impact would end. Therefore, the staff concludes the contribution of the cooling water intake operation from one or more new nuclear units to the cumulative impact on aquatic organisms in the region would be negligible, and additional mitigation would not be warranted.

The staff also considered the potential cumulative impacts related to water discharge. The geographical area over which the cumulative effects were considered for past, present, and future actions is the Mississippi River. Since the operation of GGNS Unit 1 began, heated effluent has been discharged into the river. The size of the plume that includes the combined discharge from both GGNS Unit 1 and the proposed Grand Gulf ESP facility would be small in comparison to the length and width of the Mississippi River along the Grand Gulf site. Operation of the proposed discharge structure would not be expected to affect species of special interest or Federally or State-listed threatened and endangered species.

The amount of water, its temperature and chemical composition, are regulated by the Mississippi Department of Environmental Quality (MDEQ) through the National Pollutant Discharge Elimination System (NPDES) permit program. The MDEQ regulates point sources discharging pollutants to ensure the protection and propagation of a balanced, indigenous population of fish, shellfish, and other aquatic organisms. The MDEQ is required to take into consideration the cumulative impacts of multiple discharges to the same body of water. Discharges from all sources on the Grand Gulf site and other area facilities would be included in the review and development of permit requirements for a new nuclear unit or units.

Additionally, all NPDES permits must be renewed every 5 years, allowing MDEQ to ensure the permit limits provide the appropriate level of protection to the environment. During the review of the proposed Grand Gulf ESP site, the impacts from discharge of heated effluent (for example, water temperature, dissolved oxygen, thermal stratification, impact to fauna), cold shock, and chemical treatment of the cooling water were considered. Because the NPDES permit issued by MDEQ would govern the operational impacts on the aquatic environment whether the facility operates alone or jointly with GGNS Unit 1 under a cumulative effect scenario, the operational impacts of water discharge on aquatic organisms would be minor.

In summary, the staff concludes that the contribution of construction, operation (including operation of the intake structure), and eventual decommissioning of the Grand Gulf ESP facility to the cumulative impacts on aquatic ecological resources in the region would be SMALL, and additional mitigation would not be warranted.

7.6 Socioeconomics, Historic and Cultural Resources, Environmental Justice

Much of the analyses of socioeconomic impacts presented in Sections 4.5 and 5.5 already incorporate cumulative impact analysis because the metrics used for analysis only make sense when placed in the total or cumulative context. For instance, the impact of the total number of additional housing units that may be needed can only be evaluated with respect to the total number that will be available in the affected area. Therefore, the geographical area of the cumulative analysis varies depending on the particular impacts considered, and may depend on specific boundaries, such as taxation jurisdictions, or may be distance-related, as in the case of environmental justice.

Given the current plans and construction activities for road improvements in the region of the Grand Gulf ESP, the potential cumulative increase in the number of vehicles during a combined outage, construction, and permanent workforce egress and ingress into the site are unlikely to have an adverse impact on the local road system.

The construction and operation of one or more additional units at the Grand Gulf ESP site would not be likely to add to any cumulative socioeconomic impacts beyond those already evaluated in Sections 4.5 and 5.5. In other words, the impacts of issues such as transportation or taxes are not likely to be detectable beyond the regions previously evaluated and will quickly decrease with increasing distance from the site. The staff concludes that construction impacts would generally be SMALL, but there are exceptions if more workers than expected settle in Claiborne County and Jefferson County, in which case a MODERATE impact level may be reached for the impacts on roads, housing, and some public services. In terms of beneficial effects, the impacts on regional economies would be MODERATE beneficial in Warren County and tax revenues benefit to Claiborne County would be beneficially LARGE under current Mississippi law, but would depend on how taxation of the new unit or units is resolved by the state of Mississippi.

With regard to historic and cultural resources, the construction and operation of the proposed additional unit or units at the Grand Gulf ESP site would not add to the cumulative impacts on these resources beyond those identified in Sections 4.6 and 5.6. SERI will have procedures to ensure that either known or newly discovered historic and cultural sites would not be inadvertently affected during onsite activities that involve land disturbances. Construction, operation, and maintenance of the new facility would not affect land outside the bounds of current GGNS facility operations. Therefore, any additional cumulative impacts would be negligible.

The staff found no unusual resource dependencies or practices or environmental pathways through which minority and low-income populations would be disproportionately affected. As a result, the cumulative environmental impacts related to environmental justice would be SMALL. If tax revenues dramatically increase, the residents of Claiborne County (who are disproportionately minority and low-income) would enjoy LARGE beneficial tax revenue impacts. However, if significant demands are placed on Claiborne County services as a result of more workers than expected settling in the county (without a corresponding increase in tax revenues), the socioeconomic impacts of reduced services or higher taxes would fall disproportionately on the residents of the county. In that case, the environmental justice impacts would be MODERATE.

The conclusion of LARGE net beneficial impacts by the NRC staff was based on certain assumptions. These include: there would be no more than 3150 construction workers and 1160 new operations workers at the Grand Gulf ESP site; no less than 50 percent of these workers would come from the 80-km (50-mi) region surrounding the site; new workers would tend to live in the larger communities in the region; there are no significant changes in the terms and conditions for taxability of real property under Mississippi tax law; and regional populations of minority and low-income populations will remain in the same geographic locations. The specific level within the wide range of possibilities depends largely on to what extent the local communities have access to the tax base represented by the new units.

7.7 Nonradiological Health

In Section 5.8.1, the cumulative health impacts of construction and operation of the existing GGNS Unit 1 and proposed ESP unit(s) on the ambient temperature of the Mississippi River with regard to potential formation of thermophilic microorganisms were evaluated. The evaluation showed that the addition of the Grand Gulf ESP unit(s), which would use cooling towers as the source of cooling, would not be a significant impact because the discharge would be into a large river. SERI (2005) currently uses biocides to reduce hazards from microbiological organisms in the cooling towers for GGNS Unit 1, and has committed to employ appropriate industrial hygiene practices to protect the occupational workers from the effect of thermophilic microorganisms in the cooling towers for the new unit(s). Health risk to workers is expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts on the public and workers from noise and dust emissions were also evaluated and found to be small. The staff concludes that the cumulative impacts on nonradiological health would be SMALL, and additional mitigation would not be warranted. Impacts from electromagnetic fields remain unresolved.

7.8 Radiological Impacts of Normal Operations

The radiological exposure limits and standards for the protection of the public and for occupational exposures have been developed assuming long-term exposures, and therefore incorporate the cumulative impact. As described in Section 5.9, the public and occupational doses predicted from the proposed operation of the Grand Gulf ESP unit or units would be well below regulatory limits and standards. Specifically, the site boundary dose to the maximally exposed individual from the existing unit and the proposed new unit(s) combined would be well within the regulatory standard 40 CFR Part 190. For purposes of this environmental impact statement (EIS) analysis, the geographical area within 80-km (50-mi) of the Grand Gulf ESP site was included.

As stated in Section 2.5, SERI has conducted a radiological environmental monitoring program around the Grand Gulf site since 1978. The radiological environmental monitoring program measures radiation and radioactive materials from all sources including GGNS. The NRC and the State would regulate any reasonably foreseeable future actions that could contribute to the cumulative radiological impact.

Therefore, the staff concludes that the cumulative radiological impacts of operation of the Grand Gulf ESP facility and the existing operating GGNS Unit 1 would be SMALL, and additional mitigation would not be warranted. Issues related to gas-cooled reactor design accidents are not considered to be resolved because of the lack of information.

7.9 Fuel Cycle, Transportation, and Decommissioning

The addition of the proposed unit(s) at the Grand Gulf ESP site would result in the need for additional fuel. The impacts of producing this fuel include mining of the uranium ore, milling of the ore, conversion of the uranium oxide to uranium hexafluoride, enrichment of the uranium hexafluoride, fuel fabrication where the uranium hexaflouride is converted into uranium oxide fuel pellets, and disposition of the spent fuel in a proposed Yucca Mountain repository. As discussed in Section 6.1 of this EIS, the environmental impacts of fuel-cycle activities for the proposed unit(s) would be a maximum of four times those presented in Table S–3 (10 CFR 51.51). Table S–3 provides the environmental impacts from uranium fuel cycle operations for a model 1000-MW(e) light-water reactor operating at 80 percent capacity with a 12-month fuel loading cycle and an average fuel burnup of 33,000 MWd/MTU. Per 10 CFR 51.51(a), the NRC staff considers the impacts in Table S–3 to be acceptable for the 1000-MW(e) reference reactor. As discussed in Section 6.1.1 of this EIS, advances in reactors since the development of Table S–3 impacts will have the effect of reducing environmental impacts of the operating reference reactor. For example, a number of fuel management improvements have been adopted by nuclear power plants to achieve higher performance and to reduce fuel and separative work (enrichment) requirements. Fuel cycle impacts would occur not only at the Grand Gulf site but would also be scattered to other locations in the United States or, in the case of foreign-purchased uranium, in other countries. The NRC staff considers the cumulative fuel cycle impacts of operating GGNS and the proposed ESP unit(s) for the 1000-MW(e) light-water reactor scaled model to be SMALL. Cumulative impacts for other than light-water reactor designs are not resolved.

The addition of the proposed ESP unit(s) would result in additional shipments of unirradiated fuel to the site and additional shipments of spent fuel and waste from the site. Cumulative impacts would be approximately twice that of the existing operating plants. Environmental impacts from transportation of unirradiated fuel, spent fuel, and waste are found in Section 6.2 of this EIS based on specific reactor types proposed for the proposed ESP unit(s). The following conclusions were derived from the NRC staff's analysis of unirradiated fuel shipments: (1) the number of unirradiated fuel shipments equates to less than one truck shipment per day within criteria specified in Table S–4 of 10 CFR 51.52, (2) annual dose to workers and the public would be less than the dose specified in Table S–4, and (3) health impacts are projected to be small (i.e., less than 1×10^{-4} detriment/yr). The following conclusions were derived from the NRC staff's analysis of spent fuel: (1) after accounting for conservative assumptions in the staff's evaluation, doses to the worker and the public would be within criteria specified in Table S–4, and (2) health impacts from normal conditions and accident conditions would be small (i.e., less than 0.1 detriment/yr). Regarding transportation of waste shipments, the NRC staff concluded that the normalized number of waste shipments would be within the value specified in Table S–4 for the 1100-MW(e) reference reactor. Cumulative impacts of transportation, for operating both GGNS and the proposed light-water reactor ESP unit(s), would be SMALL. Cumulative impacts for other than light-water reactor designs are not considered to be resolved. As discussed in Section 6.3 of this EIS, environmental impacts from decommissioning are expected to be small as the licensee would have to comply with decommissioning regulatory requirements. In Supplement 1 to NUREG-0586, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, the NRC staff found the impacts on radiation dose to workers and the public, waste management, water quality, air quality, ecological resources, and socioeconomics to be small (NRC 2002). However, because SERI was not required to (and did not) submit information regarding decommissioning in its ESP application, this issue is not resolved.

7.10 Staff Conclusions and Recommendations

The staff evaluated in a cumulative sense the potential impacts resulting from construction and operation, including decommissioning, of one or more new nuclear units at the Grand Gulf ESP site. For the duration of the proposed action (construction period plus 40 years of operation), the evaluation took into account the potential impacts from factors known or likely to affect the environment. This included considering conditions at the site and surrounding vicinity from past, present, and future human activities.

For each impact area, the staff concludes the potential cumulative impacts resulting from construction and operation are generally SMALL, and additional mitigation would not be warranted. However, several areas (ecological impacts from construction, socioeconomic impacts, and environmental justice) have the potential for a MODERATE impact. In these cases, mitigation measures may be warranted, including habitat restoration and assistance with infrastructure and public services in Claiborne County. In certain cases (land use, water use and water quality, terrestrial ecosystems, nonradiological health, radiological impacts of operation of non-light-water reactor designs, and decommissioning), information was not available to resolve issues. In these cases, an applicant for a construction permit or a combined license referencing the Grand Gulf ESP would have to provide the necessary information at that stage.

7.11 References

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."

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Council on Environment Quality."

System Energy Resources, Inc. (SERI). 2005. *Grand Gulf Site Early Site Permit Application.* Revision 2, Jackson, Mississippi. Available at http://www.nrc.gov/reading-rm/adams.html, Accession No. ML052780449.

U.S. Environmental Protection Agency, Region 4 and U.S. Department of Agriculture Rural Development, Mississippi State Office (EPA). 1998. "Sole Source Aquifer Memorandum of Understanding." Jackson, Mississippi.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG-1555, Office of Nuclear Reactor Regulation, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/.

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1, Volumes 1 and 2, Washington, D.C.

8.0 Environmental Impacts of the Alternatives

This chapter describes alternatives to the proposed action and discusses the environmental impacts of those alternatives. The evaluation of alternative sites is a two-step process, as set forth in NUREG-1555, Section 9.3 (NRC 2000), and stems from the U.S. Nuclear Regulatory Commission (NRC) decision related to licensing the Seabrook Nuclear Power Plant (*Public Service Co. of New Hampshire* 1977). The first step looks at a full suite of environmental issues, using reconnaissance-level information to determine if any of the alternative sites are environmentally preferable to the proposed Grand Gulf early site permit (ESP) site. If an alternative site appears environmentally preferable to the proposed site, the analysis proceeds to the second step. If not, then the evaluation of alternative sites ends at the first step. The second step considers economic, technological, and institutional factors among the environmentally preferred sites to determine if any is obviously superior to the proposed site. If there is no obviously superior site, then the proposed site prevails. A staff conclusion that an alternative site is obviously superior to System Energy Resources, Inc.'s (SERI's) proposed ESP site would normally lead to a recommendation that the ESP application be denied.

The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – developed using Council on Environmental Quality guidelines (CEQ 1997) and set forth in the footnotes to Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B. The impact categories evaluated in this chapter are the same as those used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999)[a] with the additional impact category of environmental justice. While the GEIS was developed for license renewal, it provides useful information for this review and is referenced throughout this chapter.

Because 10 CFR 52.18 does not require an environmental impact statement (EIS) for an ESP to include consideration of the benefits of construction and operation of a new reactor or reactors at the ESP site, this EIS does not consider such matters. Accordingly, should the NRC issue an ESP for the Grand Gulf ESP site, these matters would be considered in the EIS for any construction permit (CP) or combined license (COL) application that references such an ESP.

Section 8.1 discusses the no-action alternative. Section 8.2 addresses alternative energy sources. Section 8.3 examines plant design alternatives. Section 8.4 reviews SERI's region of interest (ROI) and examines its suitability and the suitability of SERI's alternative site-selection process. It describes the method Entergy Nuclear used to select the candidate and alternative

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

sites. Entergy Nuclear, a division of Entergy, documented the process used to identify alternative sites in the *Early Site Permit Selection Committee Notebook* (Entergy Nuclear 2001). Section 8.4 also examines issues that are common to all of the alternative sites and addresses them collectively for all the alternative sites, and evaluates the selected alternative sites individually. Section 8.5 summarizes the environmental impacts for the alternative sites. The comparison of the alternative sites with the Grand Gulf ESP site is made in Chapter 9.

8.1 No-Action Alternative

For purposes of this ESP application, the no-action alternative refers to a scenario in which the NRC would deny the ESP request. Upon such a denial, the construction and operation of one or more new nuclear units at the proposed ESP location in accordance with the 10 CFR Part 52 process referencing an approved ESP would not occur.

The no-action alternative generally consists of two parts. First, under the no-action alternative NRC would not issue the ESP. There are no environmental impacts associated with not issuing the ESP, except that the impacts associated with site preparation and preliminary work that could be allowed pursuant to 10 CFR 52.17(c) and 10 CFR 52.25(a) would be avoided. SERI chose not to include a site redress plan in its ESP application, and therefore, would not be permitted to undertake site preparation and preliminary work pursuant to 10 CFR 52.17(c).

Second, given that the EIS addresses the environmental effects of construction and operation as directed by the Commission in 10 CFR 52.18, the no-action alternative would result in no such construction and operation. Therefore, the impacts predicted in this EIS would not occur.

In this context, the no-action alternative would accomplish none of the benefits intended by the ESP process, which would include

- Early resolution of siting issues prior to large investments of financial capital and human resources in new plant design and construction

- Early resolution of issues on the environmental impacts of construction and operation of reactors that fall within the plant parameters

- The ability to bank sites on which nuclear plants may be located

- The facilitation of future decisions on whether to construct new nuclear power generation facilities.

8.2 Energy Alternatives

This section examines the potential environmental impacts associated with electric generating sources other than a new nuclear generation facility at the Grand Gulf ESP site; purchasing electric power from other sources to replace power that would have been generated by a new nuclear facility at the ESP site; a combination of new generating capacity and conservation measures; and other generation alternatives that were deemed not to be viable replacements for a new nuclear facility at the ESP site. Section 8.2.1 discusses energy alternatives not requiring new generating capacity. Section 8.2.2 discusses energy alternatives requiring new generating capacity. Other alternatives are discussed in Section 8.2.3. A combination of alternatives is discussed in Section 8.2.4. Section 8.2.5 compares the environmental impacts from new nuclear, coal-fired, and natural gas-fired generating units at the Grand Gulf ESP site.

In Section 9.2.2.2 of its ESP application, SERI established a target value for the desired electrical output of 2000 MW(e) for a new nuclear generating facility constructed at the Grand Gulf ESP site and used this value in its analysis of energy alternatives (SERI 2005). The staff also used this level in Section 8.2 for analyzing the potential environmental impacts of alternative energy sources. The 2000 MW(e) output level is lower than the 3000 MW(e) maximum output level used in the analysis of construction and operation impacts in Chapters 4 and 5. The 3000 MW(e) figure derives from the SERI plant parameter envelope (PPE) (see Appendix I).

8.2.1 Alternatives Not Requiring New Generating Capacity

Four alternatives to the proposed action that do not require SERI to construct new generating capacity are to

- Purchase the needed electric power from other suppliers
- Reactivate retired power plants
- Extend the operating life of existing power plants
- Implement conservation or demand side management programs.

The Commission determined (NRC 2005) that conservation or demand side management programs are not a reasonable alternative to an ESP for a base load nuclear power plant. Consequently, this alternative is not further considered.

The viability of the other three alternatives depends on when SERI would seek a CP or COL from NRC (assuming an ESP is granted). For example, the status of existing and retired nuclear power plants will vary over time. At the present time, no information is available on when SERI would seek to construct a new nuclear power facility at the Grand Gulf ESP site if it receives an ESP. If SERI is granted an ESP, the duration of the permit would be for 10 to

20 years (10 CFR 52.27(a)). In addition, if SERI is granted an ESP, it may apply for renewal of the permit under the procedures in 10 CFR 52.29 through 52.33.

The viability of the preceding alternatives also depends on whether the nuclear unit or units SERI would seek to build at the Grand Gulf ESP site would be merchant or regulated facilities. Merchant power facilities generate electricity to sell on the open market to any buyer willing to pay the price asked by the facility owner. Owners of regulated nuclear power facilities are generally obligated to sell electricity to all buyers in the designated service area, usually at a price approved by a regulatory body. In return for assuming this obligation, the owners of regulated nuclear power facilities generally receive a guarantee that the approved price can provide a rate of return commensurate with the risk/return of comparable investments. SERI has indicated its intent that a new nuclear power facility built at the ESP location would be a merchant facility operated in a base load manner to provide electricity to the competitive marketplace (SERI 2005). However, SERI also stated that it is possible that a new nuclear facility constructed at the Grand Gulf ESP site could be operated as a regulated facility (SERI 2005).

Because of the uncertainty in timing for the construction of a new nuclear generating facility at the Grand Gulf ESP site and whether the plant would be a merchant or a regulated facility, energy alternatives not requiring new generating capacity are not evaluated in great detail in this EIS.

If power to replace the capacity of a new nuclear unit were to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one of those described in the GEIS for license renewal (probably coal, natural gas, or nuclear) (NRC 1996). The description of the environmental impacts of other technologies described in the GEIS for license renewal is representative of the impacts associated with the construction and the operation of a new nuclear unit or units at the Grand Gulf ESP site. Under the purchased power alternative, the environmental impacts of power production would still occur but would be located elsewhere within the region, nation, or in another country. The environmental impacts of coal-fired and natural gas-fired plants are discussed in Section 8.2.2.

If the purchased power alternative is implemented, the only environmental unknown is whether new transmission line rights-of-way would be required. The construction of these lines could have both environmental and aesthetic consequences, particularly if new transmission line rights-of-way have to be acquired. The staff concludes that the local environmental impacts from purchased power would be SMALL when existing transmission line rights-of-way are used and could range from SMALL to LARGE if acquisition of new rights-of-way is required. The environmental impacts of power generation would depend on the generation technology and location of the generation site and, therefore, are unknown.

Nuclear power facilities are initially licensed for a period of 40 years. The license can be renewed for up to 20 years, and NRC regulations permit additional license renewal. SERI did not consider nuclear power plant license renewal in its environmental report. While SERI does not hold operating licenses for other nuclear power plants, it is a subsidiary of Entergy Corporation and other Entergy Corporation subsidiaries hold operating licenses for nuclear power plants around the country. A number of these plants have had operating licenses renewed and others are expected to seek license renewal.

The environmental impacts of continued operation of a nuclear power plant are significantly less than construction of a new plant. However, continued operation of an existing nuclear plant does not provide additional generating capacity.

Fossil plants slated for refurbishment, predominately coal- and natural gas-fired plants, tend to be ones that are old enough to have difficulty in economically meeting today's restrictions on air contaminant emissions and, as a result, would require extensive refurbishing to meet the more restrictive environmental standards at great economic cost. As a result, SERI concluded that the environmental impacts of a refurbishment scenario are bounded by the coal- and natural gas-fired alternatives.

The staff believes that it is unreasonable for an applicant to request a CP or COL if power could be purchased from other electricity suppliers at a reasonable cost, or if the power could be obtained by reactivating one or more of SERI's retired generating plants or by extending the life of one or more existing generating plants.

The staff concludes that the options of purchasing electric power from other suppliers, reactivating retired power plants, and extending the operating life of existing power plants are not reasonable alternatives to providing new base load power generation capacity.

8.2.2 Alternatives Requiring New Generating Capacity

In keeping with the NRC's evaluation of alternatives to license renewal, a reasonable set of energy alternatives to the construction and operation of one or more new nuclear units at the Grand Gulf ESP site should be limited to analysis of discrete power generation sources and those power generation technologies that are technically reasonable and commercially viable (NRC 1996). The current mix of base load power generation options in Mississippi is one indicator of the feasible choices for power generation technology within the State.

This section discusses the environmental impacts of those energy alternatives to the proposed action that would require SERI to construct new generating capacity, and is limited to the individual alternatives that are viable: coal-fired and natural gas-fired generation. The impacts discussed in this section are estimates based on present technology. It is not known with certainty when one or more new nuclear generating units might be constructed at the Grand Gulf ESP site.

The staff assumed that new generation capacity would be located at the Grand Gulf ESP site for the coal-fired and natural gas-fired alternatives. Consistent with the cooling system assumption made by SERI for siting a new nuclear generating plant at the Grand Gulf ESP site (SERI 2005), a closed-cycle cooling system using either natural draft or mechanical cooling towers is also assumed for the coal-fired and natural gas-fired alternatives. For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the Grand Gulf ESP site (SERI 2005), albeit that upgrades, including transmission line right-of-way widening, may be necessary within the existing rights-of-way. Given the original plan for the Grand Gulf site was for multiple units, the staff finds this reasonable for new capacity up to the available transmission capacity margin. The analysis of alternative energy sources provided by SERI in its application draws on the information in Sections 8.2.1 and 8.2.2 of the supplemental EIS prepared by NRC related to the application to renew the operating licenses for Peach Bottom Atomic Power Station, Units 2 and 3 (NRC 2003).

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an annual energy outlook. In its *Annual Energy Outlook 2005*, the EIA reference case projects that combined-cycle, combustion turbine, or distributed generation technology fueled by natural gas is likely to account for more than 60 percent of new electricity-generating capacity added between 2004 and 2025 (DOE/EIA 2005). Combined-cycle technology can be used to meet base load requirements. In the combined-cycle unit, hot combustion gases in a combustion turbine rotate the turbine to generate electricity. Waste combustion heat from the combustion turbine is routed through a heat-recovery boiler to make steam to generate additional electricity.

Coal-fired plants are projected by EIA to account for nearly 33 percent of new capacity during this period. Coal-fired plants are generally used to meet base load requirements. Renewable generating units are projected by EIA to account for approximately 5 percent of the projected capacity expansion during the 2004-2025 time period.

The EIA projections are based on the assumption that providers of new generating capacity will seek to minimize cost while meeting applicable environmental requirements. EIA projects that oil-fired plants will account for no new generation capacity in the United States through the year 2025, except for limited industrial combined heat and power applications because of higher fuel costs and lower efficiencies (DOE/EIA 2005).

8.2.2.1 Coal-Fired Power Generation

SERI chose to evaluate coal-fired generation in its environmental report. The staff assumed construction of four 509 MW(e) coal-fired units at the Grand Gulf ESP site. These assumptions are consistent with the application submitted by SERI (SERI 2005). The plant is assumed to have an operating life of 40 years.

Coal and lime (calcium oxide) or limestone (calcium carbonate) for a coal-fired plant would be delivered to the plant by railroad or barge. Currently there is no rail service to the Grand Gulf site or in the vicinity of the site (SERI 2005). SERI estimates that the plant would consume approximately 6 million MT/yr (6.6 million tons/yr) of pulverized bituminous coal with an ash content of approximately 11.9 percent (SERI 2005). Lime or limestone, used in the scrubbing process for control of sulfur dioxide emissions, is injected as a slurry into the hot effluent combustion gases to remove entrained sulfur dioxide. The lime-based scrubbing solution reacts with sulfur dioxide to form calcium sulfite, which precipitates and is removed from the process as sludge. SERI estimates that approximately 223,000 MT (246,000 tons) of lime would be used annually for flue gas desulfurization (SERI 2005).

Air Quality

SERI has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. In the environmental report, SERI (SERI 2005) estimates the coal-fired alternative emissions for sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM) to be as follows:

- SO_x – 12,100 MT (13,340 tons) per year
- NO_x – 11,600 MT (12,800 tons) per year
- CO – 1500 MT (1650 tons) per year
- PM – 350 MT (390 tons) per year.

The impacts on air quality from coal-fired generation would vary considerably from those of nuclear generation because of emissions of SO_x, NO_x, CO, PM, and hazardous air pollutants such as mercury. A coal-fired plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

The acid rain requirements of the Clean Air Act capped the nation’s sulfur dioxide emissions from power plants. SERI would have to obtain sufficient pollution credits either from a set-aside pool or purchases on the open market to cover annual emissions from the plant. The market-based allowance system used for sulfur dioxide emissions is not used for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standard for such plants (40 CFR 60.44a(d)(1)), which limits the discharge of any gases that contain NO_x (expressed as nitrogen dioxide) to 200 ng/J (1.6 lb/MWh) of gross energy output, based on a 30-day rolling average.

A new coal-fired generation plant would likely need a prevention of significant deterioration permit and an operating permit under the Clean Air Act. The plant would need to comply with the new source performance standards for such plants in 40 CFR Part 60 Subpart Da. The standards establish emission limits for particulate matter and opacity (40 CFR 60.42a), sulfur dioxide (40 CFR 60.43a), and nitrogen oxide (40 CFR 60.44a).

The U.S. Environmental Protection Agency (EPA) has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified for criteria pollutants under the Clean Air Act (40 CFR 51.307(a)). Criteria pollutants under the Clean Air Act are lead, ozone, particulates, carbon monoxide, nitrogen oxide, and sulfur dioxide. Ambient air quality standards for criteria pollutants are in 40 CFR Part 50. The Grand Gulf ESP site is in an area designated as attainment or unclassified for criteria pollutants (40 CFR 81.325).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment occurs because of air pollution resulting from human activities. In addition, EPA regulations provide that, for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for those days on which visibility is most impaired over the period of the implementation plan and ensure no degradation in visibility for the least visibility-impaired days over the same period (40 CFR 51.308(d)(1)). If a new coal-fired power station were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no mandatory Class I Federal areas within 160 km (100 mi) of the Grand Gulf ESP site. Louisiana has one Class I Federal area, the Breton Wilderness. The Breton Wilderness is located approximately 320 km (200 mi) southeast of the Grand Gulf ESP site.

The GEIS for license renewal (NRC 1996) did not quantify emissions from coal-fired power plants, but implied that air impacts would be substantial. The GEIS also mentioned global warming from unregulated carbon dioxide emissions and acid rain from sulfur oxides and nitrogen oxide emissions as a potential impact (NRC 1996). Adverse human health effects, such as cancer and emphysema, have been associated with the products of coal combustion. Overall, the staff concludes that air quality impacts from coal-fired generation would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Waste Management

The GEIS for license renewal (NRC 1996) and NRC experience from license renewal analyses indicate that coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and scrubber sludge. In the environmental report, SERI estimates that a 2000 MW(e) coal-fired plant would generate approximately 711,000 MT (784,000 tons) of ash and spent catalyst and an additional 660,000 MT (728,000 tons) of scrubber sludge annually (SERI 2005).

In May 2000, EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (65 FR 32214). EPA concluded that some form of national regulation is warranted to address coal combustion waste products because of health concerns. Accordingly, EPA announced its intention to issue regulations for disposal of coal-combustion waste under subtitle D of the Resource Conservation and Recovery Act (RCRA 1976).

Waste impacts on groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Construction-related debris would be generated during plant construction activities.

For the reasons stated above, the staff concludes that the impacts from waste generated at a coal-fired plant would be MODERATE. The impacts would be clearly noticeable, but would not destabilize any important resource.

Human Health

Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of coal-combustion waste, and public risk from inhalation of stack emissions. In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. The EPA has recently concluded that certain segments of the U.S. population (such as the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects caused by exposures to mercury from sources such as coal-fired power plants. However, given the regulatory oversight exercised by the EPA and by State agencies, the staff concludes that the human health impacts from radiological doses and inhaled toxins and particulates generated from coal-fired generation would be SMALL.

Other Impacts

Approximately 610 ha (1500 ac) of land would need to be converted to industrial use for the power block, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. Given the proximity of the ESP site to the Mississippi River, ash, scrubber sludge, and spent SCR catalyst (used for control of nitrogen oxide emissions) would likely be disposed of offsite. Disposal of ash and sludge over a 40-year plant life would require approximately 320 ha (790 ac) of the 610 ha (1500 ac). Additional land may be needed in the site vicinity for infrastructure facilities, rail spur, and cooling water intake and discharge facilities. Total land requirements would be approximately 1085 ha (2680 ac) (SERI 2005). Additional land adjacent to the ESP site would likely need to be acquired by SERI if the coal alternative were to be implemented. The Grand Gulf site consists of approximately 850 ha (2100 ac), about half of which lies in seasonally flooded bottomlands (SERI 2005). Land use changes would occur offsite in an undetermined coal-mining area to supply coal for the plant. Overall, the staff concludes that the land-use impacts would be MODERATE.

The coal-fired generation alternative would introduce impacts from construction and new incremental impacts from operations. The impacts could include wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity. The impacts could occur at the ESP site and at the sites used for coal and limestone mining. Extraction of cooling makeup water could have adverse impacts on aquatic resources. Construction and maintenance of a rail spur and, only if needed, new or upgraded transmission lines would have ecological impacts. Cooling tower drift would have minimal impacts on terrestrial ecology. Disposal of fly ash could affect water quality and the aquatic environment. The impacts on threatened and endangered species at the ESP site would be similar to the impacts from a new nuclear facility. Overall, the staff concludes that the ecological impacts could be MODERATE to LARGE.

The impacts on water use and quality from constructing and operating a coal-fired plant at the ESP site would be comparable to the impacts associated with a new nuclear facility. Cooling water would likely be withdrawn directly from the Mississippi River or from collector wells located in the floodplain. Closed-cycle cooling with cooling towers is assumed. Plant discharges would consist mostly of cooling tower blowdown, characterized primarily by an increased temperature and concentration of dissolved solids relative to the receiving water body and intermittent low concentrations of biocides (for example, chlorine). Treated process waste streams and sanitary wastewater may also be discharged. All discharges would be regulated by the Mississippi Department of Environmental Quality (MDEQ) through a National Pollution Discharge Elimination System (NPDES) permit. Indirectly, water quality could be affected by acids and mercury from air emissions. Water would be consumed because of evaporation from the cooling towers. In the GEIS for license renewal the staff determined that some erosion and sedimentation would likely occur during construction (NRC 1996). Overall, the staff concludes that the water use and quality impacts would be SMALL.

Socioeconomic impacts would result from the approximately 300 workers needed to operate the coal-fired facility, demands on housing and public services during construction, and the loss of jobs after construction. Overall, the staff concludes that these impacts would be SMALL to MODERATE, resulting from the mitigating influence of the site's proximity to the surrounding population area and the relatively small number of workers needed to operate the plant. The plant would pay very significant property taxes to Claiborne County. Considering the population and economic condition of the County, the staff concludes that the taxes would have a LARGE beneficial impact on the County.

The four coal-fired power block units would be as much as 60 m (200 ft) tall and would be visible offsite during daylight hours. The four exhaust stacks would be as much as 180 m (600 ft) high. The stacks and associated emissions would likely be visible in daylight hours for distances greater than 16 km (10 mi). Cooling towers and associated plumes also would have aesthetic impacts. Natural draft towers could be up to 170 m (550 ft) high (SERI 2005), and mechanical draft towers could be up to 30 m (100 ft) high. The stacks would be visible from parks and other recreational areas in the vicinity of the plant. The power block units and associated stacks and cooling towers would also be visible at night because of outside lighting. The Federal Aviation Administration generally requires that all structures exceeding an overall height of 61 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2000). A mitigating factor is that the Grand Gulf ESP site is currently an industrial site located in a rural, forested area. The visual impacts of a new coal-fired plant could be further mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting, provided the lighting meets Federal Aviation Administration requirements, and appropriate use of shielding. For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the Grand Gulf site (SERI 2005). However, as discussed in Section 4.1.2, some widening of the transmission line rights-of-way and related support structures could be needed.

Coal-fired power generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations and mechanical draft cooling towers. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and lime/limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route if rail service is re-established. Although noise from passing trains significantly increases noise levels near the rail corridor, the short duration of the noise reduces the impacts. Nevertheless, given the frequency of train transport and the fact that many people are likely to be within hearing distance of the railway, the impacts of noise on residents in the vicinity of the facility and of the rail line are considered significant. Noise associated with barge transportation of coal and lime/limestone would be minor. Noise and light from the plant would be detectable offsite.

For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the ESP site (SERI 2005). Given the original plan for the Grand Gulf site was for multiple units, the staff finds this assumption reasonable for new capacity up to the available transmission capacity margin. Constructing and operating a coal-fired generation plant would be consistent with the industrial nature of the ESP site. Although best management practices would be expected to be implemented, the viewshed would be affected. Therefore, the staff concludes that the visual and aesthetic impacts of a coal-fired generation plant would be MODERATE.

The ESP site was disturbed during construction of the Grand Gulf Nuclear Station (GGNS). As a result, significant historic and cultural resource impacts would be unlikely and would be minimized by survey and recovery techniques. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse effect from ground-disturbing actions. Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new power plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the plant site, any offsite affected areas, such as mining and waste disposal sites, and along associated rights-of-way where new construction would occur, for example, roads, transmission line rights-of-way (if transmission capacity margins were approached), rail lines, or other rights-of-way. The staff concludes that the historic and cultural resource impacts would be SMALL.

There is evidence of potential environmental justice issues at the ESP site. Some MODERATE adverse impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations. Local property tax yields, however, should be beneficial and LARGE. Therefore, the staff concludes that environmental justice impacts would be LARGE and beneficial.

Other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The impacts of coal-fired power generation at the ESP site are summarized in Table 8-1.

Table 8-1. Summary of Environmental Impacts of Coal-Fired Power Generation – 2000 MW(e)

Impact Category	Impact	Comment
Air quality	MODERATE	SO_x – 12,100 MT (13,340 tons) per year NO_x – 11,600 MT (12,800 tons) per year CO – 1500 MT (1650 tons) per year PM – 350 MT (390 tons) per year Small amounts of hazardous air pollutants.
Waste management	MODERATE	Total waste volume would be approximately 711,000 MT/yr (784,000 tons/yr) of ash and spent catalyst and an additional 660,000 MT/yr (728,000 tons/yr) of scrubber sludge.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Land use	MODERATE	Uses up to 1085 ha (2680 ac) for power block; coal handling, storage, and transportation facilities; infrastructure facilities; waste disposal; rail spur; and cooling-water facilities. Mining activities would have additional impacts offsite.
Ecology	MODERATE to LARGE	Uses the undeveloped upland area of the ESP site and probably some adjacent offsite undeveloped land. Potential upland hardwood forest loss and fragmentation, reduced productivity and biological diversity, and impacts on terrestrial ecology from cooling tower drift. Additional impacts associated with coal mining and construction of a rail spur.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear facility located at the ESP site.
Socioeconomics	LARGE Beneficial	Construction-related impacts would be noticeable. Impacts during operation would be minor. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Impacts during operation likely would be smaller than during construction.
Aesthetics	MODERATE	Best management practices can be used to mitigate visual impacts from exhaust stacks, cooling towers, and plumes. Some offsite noise impacts would occur.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	LARGE Beneficial	Some adverse impacts on housing availability and prices during construction may occur. Local property tax revenues could be major and beneficial during operations.

8.2.2.2 Natural Gas-Fired Power Generation

SERI chose to evaluate natural gas-fired generation in its environmental report. For this alternative, the staff assumed construction and operation of a natural gas-fired plant with a closed-cycle cooling system and cooling towers located at the Grand Gulf ESP site. The staff assumed that the natural gas-fired plant would use combined-cycle combustion turbines, which is consistent with the SERI ESP application (SERI 2005). The staff also used the SERI assumption of four units with a net capacity of 508 MW(e) per unit (SERI 2005).

Air Quality

Natural gas is a relatively clean-burning fuel. When compared with a coal-fired plant, a natural gas-fired plant would release similar types of emissions but in lower quantities.

A new natural gas-fired power generation plant would likely need a prevention of significant deterioration permit and an operating permit under the Clean Air Act. A new combined-cycle, natural gas-fired plant would also be subject to the new source performance standards specified in 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, sulfur dioxide, and nitrogen oxides.

EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as attainment or unclassified under the Clean Air Act. The Grand Gulf ESP site is in an area designated as attainment or unclassified for criteria pollutants (40 CFR 81.325).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment in mandatory Class I Federal areas when impairment is from air pollution caused by human activities. In addition, EPA regulations provide, that for each mandatory Class I Federal area located within a State, State regulatory agencies must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ensure no degradation in visibility for the least impaired days over the same period (40 CFR 51.308(d)(1)). If a new natural gas-fired power plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no mandatory Class I Federal areas within 160 km (100 mi) of the Grand Gulf ESP site. Louisiana has one Class I Federal area, the Breton Wilderness. The Breton Wilderness is located approximately 320 km (200 mi) southeast of the Grand Gulf ESP site.

SERI estimates that a natural gas-fired plant equipped with appropriate pollution control technology would have approximately the following emissions (SERI 2005):

- SO_x – 109 MT (120 tons) per year
- NO_x – 417 MT (460 tons) per year
- CO – 553 MT (610 tons) per year
- PM_{10} – 63 MT (70 tons) per year.

PM_{10} is particulate matter having an aerodynamic diameter less than or equal to 10 µm (40 CFR 50.6(c)). A natural gas-fired power plant would also have unregulated carbon dioxide emissions that could contribute to global warming.

The combustion turbine portion of the combined-cycle plant would be subject to EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR Part 63, Subpart YYYY) if the site is a major source of hazardous air pollutants. Major sources have the potential to emit 10 tons/yr or more of any single hazardous air pollutant or 25 tons/yr or more of any combination of hazardous air pollutants (40 CFR 63.6085(b)).

The fugitive dust emissions from construction activities would be mitigated using best management practices; such emissions would be temporary.

The impacts of emissions from a natural gas-fired power generation plant would be clearly noticeable, but would not be sufficient to destabilize air resources. Overall, the staff concludes that air quality impacts resulting from construction and operation from new natural gas-fired power generation at the ESP site would be SMALL to MODERATE.

Waste Management

In the GEIS, the staff concluded that waste generation from natural gas-fired technology would be minimal (NRC 1996). The only significant waste generated at a natural gas-fired power plant would be spent SCR catalyst, which is used to control NO_x emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent SCR catalyst, waste generation at an operating natural gas-fired plant would be largely limited to typical office waste. Construction-related debris would be generated during construction activities. Overall, the staff concludes that waste impacts from natural gas-fired power generation would be SMALL.

Human Health

In the GEIS, the staff identified cancer and emphysema as a potential health risk from natural gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risk. Air emissions from a natural gas-fired power generation plant located at the Grand Gulf ESP site would be regulated by the MDEQ.

The human health effect is expected to be either undetectable or sufficiently minor. Overall, the staff concludes that the impacts on human health from natural gas-fired power generation would be SMALL.

Other Impacts

The natural gas-fired generating plant would require approximately 45 ha (110 ac) for the power block and support facilities and likely would be sited on land that was previously disturbed during the construction of GGNS Unit 1 (SERI 2005). Assuming the natural gas-fired plant uses a closed-cycle cooling system, an additional land area of up to 12 ha (30 ac) would be required for cooling towers and support systems. Construction of a natural gas pipeline from the Grand Gulf ESP site to the closest natural gas distribution line could require up to 34 ha (85 ac) (SERI 2005). Thus, the total land use commitment would be approximately 91 ha (225 ac) (SERI 2005). For any new natural gas-fired power plant, additional land would be required for natural gas wells and collection stations. In the GEIS, the staff estimated that approximately 1500 ha (3600 ac) would be needed for a 1000-MW(e) plant (NRC 1996). Information from the GEIS for license renewal is useful for this analysis as well. Overall, the staff concludes that land-use impacts from new natural gas-fired power generation would be SMALL.

Siting of the natural gas-fired plant would have ecological impacts that would be less than a new nuclear facility. Much of the impact would occur in areas that were previously disturbed during the construction of GGNS Unit 1. Constructing a new underground gas pipeline to the site would cause temporary ecological impacts. Ecological impacts on the plant site and utility easements would not affect threatened or endangered species, although some wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity would be likely. Withdrawal and discharge of makeup water for the cooling system could affect aquatic resources, and drift of condensation from the cooling towers could affect terrestrial ecology. Overall, the staff concludes that ecological impacts would be SMALL to MODERATE.

The impacts on water use and quality from constructing and operating a natural gas-fired plant at the Grand Gulf ESP site would be comparable to the impacts associated with constructing and operating a new nuclear facility. Closed-cycle cooling with cooling towers is assumed. The impacts on water quality from sedimentation during construction of a natural gas-fired plant were characterized in the GEIS as SMALL (NRC 1996). NRC also noted in the GEIS that the impacts on water quality from operations would be similar to, or less than, the impacts from other generating technologies. Information from the GEIS for license renewal is useful for this analysis as well. Overall, the staff concludes that impacts on water use and quality would be SMALL.

Socioeconomic impacts would result from the approximately 150 workers needed to operate the natural gas-fired facility, demands on housing and public services during construction, and the loss of jobs after construction. Overall, the staff concludes that these impacts would be SMALL because of the mitigating influence of the site's proximity to the surrounding population area and the relatively small number of workers needed to construct and operate the plant in comparison to nuclear and coal-fired generation alternatives. The plant would pay property taxes to Claiborne County. Considering the population and economic condition of the County, the staff concludes that the taxes would have a MODERATE beneficial impact on the County.

The turbine buildings, four exhaust stacks (approximately 60 m (200 ft) tall) and associated emissions, cooling towers, condensation plumes from the cooling towers, and the gas pipeline compressors would be visible during daylight hours from offsite. Noise and light from the plant would be detectable offsite. For the purpose of its ESP application, SERI assumed that no new electric power transmission lines would be needed to serve a new generating facility located at the Grand Gulf site (SERI 2005). However, as discussed in Section 4.1.2, some widening of the rights-of-way and related support structures could be needed. A mitigating factor is that the Grand Gulf ESP site is currently an industrial site located in a rural, forested area. Overall, the staff concludes that the aesthetic impacts associated with new natural gas-fired power generation at the Grand Gulf ESP site would be SMALL.

The ESP site was disturbed during construction of the GGNS. As a result, significant historical and cultural and historic resource impacts would be unlikely and would be minimized by survey and recovery techniques. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse effects from ground-disturbing actions. Before construction, studies would likely be needed to identify, evaluate, and address mitigation of the potential impacts of new power plant construction on cultural resources. The studies would likely be needed for all areas of potential disturbance at the plant site, any offsite affected areas, and along associated rights-of-way where new construction would occur (for example, roads, transmission line rights-of-way, rail lines, or other rights-of-way). The staff concludes that the historic and cultural resource impacts would be SMALL.

There is evidence of potential environmental justice issues at the ESP site. Some temporary impacts on housing availability and prices during construction might occur, which could disproportionately affect minority and low-income populations, but there would be moderate property tax revenues during operations. Therefore, the staff concludes that environmental justice impacts would be MODERATE and beneficial.

Other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The impacts of natural gas-fired power generation at the ESP site are summarized in Table 8-2.

Table 8-2. Summary of Environmental Impacts of Natural Gas-Fired Power Generation – 2000 MW(e)

Impact Category	Impact	Comment
Air quality	SMALL to MODERATE	SO_x – 109 MT (120 tons) per year NO_x – 417 MT (460 tons) per year CO – 553 MT (610 tons) per year PM_{10} – 64 MT (70 tons) per year Some hazardous air pollutants.
Waste management	SMALL	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Land use	SMALL	90 ha (225 ac) would be needed for power block, cooling towers and support systems, and connection to a natural gas pipeline. Additional land might be needed for infrastructure and other facilities.
Ecology	SMALL to MODERATE	Many of the impacts would occur in areas that were previously disturbed during the construction of GGNS Unit 1. Thus, potential habitat loss and fragmentation and reduced productivity and biological diversity would be negligible. Impacts on terrestrial ecology from cooling tower drift could occur.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear plant located at the ESP site.
Socioeconomics	MODERATE Beneficial	Construction and operations workforces are both relatively small. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small work-force involved.
Aesthetics	SMALL	Best management practices can be used to mitigate visual impacts from the plant buildings, exhaust stacks, cooling towers, and condensation plumes from operation of the cooling towers.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	MODERATE Beneficial	Some impacts on housing availability and prices during construction may occur, as might beneficial impacts from property tax revenues.

8.2.3 Other Alternatives

This section discusses alternatives that SERI determined are not reasonable, the staff's conclusions about the overall environmental impacts of each alternative, and the staff's basis for the conclusions. New nuclear units at the ESP site would be a base load generation plant. Any feasible alternative to the new units would need to generate base load power. In performing its initial evaluation in the environmental report, SERI relied on the GEIS for license renewal (NRC 1996). The staff reviewed the information submitted by SERI and conducted the NRC staff's independent review and finds that SERI's conclusion that these generation options are not reasonable alternatives to one or more new nuclear units is acceptable.

The staff has not assigned significance levels to the environmental impacts associated with the alternatives discussed in this section because, in general, the generation alternatives would have to be installed at a location other than the ESP site. Any attempt to assign significance levels would require staff speculation about the unknown site.

8.2.3.1 Oil-Fired Power Generation

The EIA projects that, because of higher fuel costs and lower efficiencies, oil-fired power plants will not provide new power generation capacity in the United States through the year 2025, except for limited industrial combined heat and power applications (DOE/EIA 2005). Oil-fired generation is more expensive than either the nuclear or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has resulted in a decline in its use for electricity generation. In Section 8.3.11 of the GEIS for license renewal, the staff estimated that construction of a 1000 MW(e) oil-fired plant would require about 49 ha (120 ac) of land (NRC 1996).

For the proceeding reasons, the staff concludes that an oil-fired power plant at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility that would be operated as a base load plant.

8.2.3.2 Wind Power

Mississippi and Louisiana are in a wind power Class 1 region (average wind speeds lower than 5.6 m/s) (DOE 2004a). Class 1 regions have the lowest potential for wind energy generation (DOE 2004a). Mississippi does not have sufficient wind resources to use large-scale wind turbines (DOE 2004b). Small wind turbines may have applications in some areas of the state (DOE 2004b). Wind turbines typically operate at a 25 to 35 percent capacity factor compared to 90 to 95 percent for a base load plant such as a nuclear plant (NWPPC 2000).

For the preceding reasons, the staff concludes that a wind energy facility at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility that would be operated as a base load plant.

8.2.3.3 Solar Power

Solar technologies use energy and light from the sun to provide heating and cooling, light, hot water, and electricity for consumers. Solar power technologies (both photovoltaic and thermal) cannot currently compete with conventional nuclear and fossil-fueled technologies in grid-connected applications because of solar power's higher capital cost per kilowatt of capacity. Energy storage requirements also limit the use of solar energy systems as base load electricity supply. In the GEIS for license renewal, the staff determined that the average capacity factor of photovoltaic cells is about 25 percent, and the capacity factor for solar thermal systems is about 25 to 40 percent (NRC 1996).

Construction of solar generating facilities has substantial impacts on natural resources (such as wildlife habitat, land use, and aesthetics). As stated in the GEIS, land requirements are high – 142 km^2 (55 mi^2) per 1000 MW(e) for photovoltaic (NRC 1996) and approximately 57 km^2 (22 mi^2) per 1000 MW(e) for solar thermal systems (NRC 1996). Neither type of solar electric system would fit the land area footprint available at the Grand Gulf ESP site.

The Grand Gulf ESP site receives approximately 4500 to 5000 watt-hr/m^2/day that can be used for flat-plate solar systems, and approximately 4000 to 4500 watt-hr/m^2/day that can be used for solar concentrating systems (DOE 2004c). Areas in the southwest United States receive up to 7500 watt-hr/m^2/day (DOE 2004c). The solar resource in Mississippi can be used for water heating or photovoltaic systems but not for large concentrating solar thermal utility systems (DOE 2004c).

For the preceding reasons, the staff concludes that a solar energy facility at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility that would be operated as a base load plant.

8.2.3.4 Hydropower

Mississippi has an estimated 92 MW of developable hydroelectric resources (INEEL 1997). As stated in Section 8.3.4 of the GEIS for license renewal (NRC 1996), the percentage of U.S. generating capacity supplied by hydropower is expected to decline because hydroelectric facilities have become difficult to site as a result of public concerns about flooding, destruction of natural habitat, and alteration of natural river courses. In the GEIS, the staff estimated that land requirements for hydroelectric power are approximately 400,000 ha (1 million ac) per 1000 MW(e) (NRC 1996). Because of the relatively low amount of undeveloped hydropower resource in Mississippi and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 2000 MW(e), the staff concludes that local hydropower is not a feasible alternative to construction of a new nuclear power generation facility operated as a base load plant at the Grand Gulf ESP site.

8.2.3.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for base load power where available. However, geothermal technology is not widely used as base load power generation because of the limited geographical availability of the resource and immature status of the technology (NRC 1996). Geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. Mississippi has low-to-moderate geothermal resources that can be tapped for direct heat or for geothermal heat pumps. However, electricity generation is not possible with these resources (DOE 2004d). No feasible eastern location for geothermal capacity can serve as an alternative to a base load nuclear power plant.

For the preceding reasons, the staff concludes that a geothermal energy facility at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.6 Wood Waste

In the GEIS for license renewal, the staff determined that a wood-burning facility can provide base load power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a base load power plant, the ecological impacts of large-scale timber cutting (for example, soil erosion and loss of wildlife habitat), and high inefficiency, the staff has determined that wood waste is not a feasible alternative to a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.7 Municipal Solid Waste

Municipal solid-waste combustors incinerate the waste and use the resultant heat to produce steam, hot water, or electricity. The combustion process can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2004). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the United States. This group of technologies processes raw municipal solid waste “as is,” with little or no sizing, shredding, or separation before combustion. In the GEIS for license renewal, the staff determined that the initial capital cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Municipal solid waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue gases using fabric filters and/or scrubbers (DOE/EIA 2001).

Currently, approximately 89 waste-to-energy plants are operating in the United States. These plants generate approximately 2500 MW(e), or an average of approximately 28 MW(e) per plant (IWSA 2004). For the preceding reasons, the staff concludes that generating electricity from municipal solid waste would not be a feasible alternative to a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuel, several other biomass-derived fuels are available for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). In the GEIS for license renewal, the staff determined that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a large base load plant (NRC 1996). For these reasons, the staff concludes that such fuels do not offer a feasible alternative to a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.3.9 Fuel Cells

Fuel cells work without combustion and its associated environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode, and then separating the two by an electrolyte. The only by-products are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

During the past three decades, significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, but progress has been slow (DOE 2004e). Currently, the most widely marketed fuel cells cost about $4500 per kW of installed capacity. By contrast, a diesel generator costs $800 to $1500 per kW of installed capacity, and a natural gas turbine can be even less (DOE 2004e).

DOE initiated a program – the Solid State Energy Conversion Alliance – to bring about dramatic reductions in fuel cell cost. DOE's goal is to cut costs to as low as $400 per kW of installed capacity by the end of this decade, which would make fuel cells competitive for virtually every type of power application (DOE 2004e).

The staff concludes that, at the present time, fuel cells are not economically or technologically competitive with other alternatives for base load electricity generation. Future gains in cost competitiveness for fuels cells compared to other fuels are speculative.

For the preceding reasons, the staff concludes that a fuel cell energy facility located at or in the vicinity of the Grand Gulf ESP site would not be an economical alternative to construction of a 2000 MW(e) nuclear power generation facility operated as a base load plant.

8.2.4 Combination of Alternatives

Individual alternatives to the construction of one or more new nuclear units at the Grand Gulf ESP site might not be sufficient on their own to generate SERI's target value of 2000 MW(e) because of the small size of the resource or lack of cost-effective opportunities. Nevertheless, it is conceivable that a combination of alternatives might be cost effective. There are many possible combinations of alternatives.

Section 8.2.2.2 assumes the construction of four 508 MW(e) natural gas combined-cycle generating units at the Grand Gulf ESP site using closed-cycle cooling with cooling towers. For a combined alternatives option, the staff assessed the environmental impacts of an assumed combination of three 508 MW(e) natural gas combined-cycle generating units at the Grand Gulf ESP site using closed-cycle cooling with cooling towers, 30 MW of wind energy, 30 MW of hydropower, 90 MW from biomass sources including municipal solid waste, and 326 MW from conservation and demand-side management programs. A summary of the environmental impacts of this combination of alternatives is in Table 8-3.

8.2.5 Summary Comparison of Alternatives

Table 8-4 contains a summary of environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural gas-fired, combined-cycle generating units at the Grand Gulf ESP site. The combination of alternatives shown in Table 8-4 assumes siting of natural gas-fired/combined-cycle units at the ESP site and siting of other generating units in the general vicinity (within 160 km (100 mi)) of the site. Closed-cycle cooling with cooling towers is assumed for all thermal plants.

The staff reviewed the available information on the environmental impacts of power generation alternatives compared to the construction of new nuclear units at the Grand Gulf ESP site. Based on this review, the staff concludes that, from an environmental perspective, none of the viable energy alternatives are obviously superior to construction of a new base load nuclear power generation plant. If significant changes in generation technology or environmental impacts associated with particular generation technologies should occur and an ESP holder seeks a CP or COL to build a new nuclear generating plant at an ESP location, the staff would verify the analysis of energy alternatives conducted at the ESP stage.

8.3 Plant Design Alternatives

An important factor in assessing environmental impacts on the terrestrial and aquatic environments in the vicinity of a nuclear power plant site is the selection of heat-dissipation and circulating water systems. In Sections 9.4.1 and 9.4.2 of its environmental report, SERI described the selection and evaluation process that resulted in its decision to propose natural or mechanical draft cooling towers or both with a makeup water intake in the Mississippi River and a blowdown discharge outfall downstream of the intake (SERI 2005).

Table 8-3. Summary of Environmental Impacts of a Combination of Power Sources – 2000 MW(e)

Impact Category	Impact	Comment
Air quality[(a)]	SMALL to MODERATE	SO_x – 82 MT (90 tons) per year NO_x – 313 MT (345 tons) per year CO – 415 MT (458 tons) per year PM_{10} – 48 MT (53 tons) per year Some hazardous air pollutants.
Waste management	SMALL	The only significant waste would be spent SCR catalyst used for control of NO_x emissions and ash from biomass sources.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Land use	SMALL to MODERATE	Natural gas-fired plant would have land use impacts for power block, cooling towers and support systems, and connection to a natural gas pipeline. Wind, hydro, and biomass facilities and associated transmission lines would also have land use impacts.
Ecology	SMALL to MODERATE	Many of the impacts would occur in areas that were previously disturbed during the construction of GGNS Unit 1. Thus, potential habitat loss and fragmentation and reduced productivity and biological diversity would be minimal. Impacts on terrestrial ecology from cooling tower drift could occur. Wind energy facilities could result in some avian mortality. Hydropower facilities would impact terrestrial and aquatic habitat.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear plant located at the ESP site.
Socioeconomics	MODERATE Beneficial	Construction and operations workforces are both relatively small. Addition to property tax base, while smaller than for a nuclear, coal-fired, or solely natural gas-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small workforce involved.
Aesthetics	SMALL to MODERATE	Best management practices can be used to mitigate visual impacts from plant buildings, exhaust stacks, cooling towers, and condensation plumes from operation of the cooling towers. Wind energy towers would have aesthetic impact.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facilities and infrastructure at the Grand Gulf ESP site would be built on previously disturbed ground.
Environmental justice	MODERATE Beneficial	Some impacts on housing availability and prices during construction may occur as might beneficial impacts from property tax revenues.

(a) Impacts are principally from natural gas-fired power generation. Municipal solid waste or biomass facilities may generate some additional emissions.

Table 8-4. Summary of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural Gas-Fired Generating Units, and a Combination of Alternatives

Impact Category	Nuclear	Coal	Natural Gas	Combination of Alternatives
Air quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Waste management	SMALL	MODERATE	SMALL	SMALL
Human health	SMALL	SMALL	SMALL	SMALL
Land use	SMALL	MODERATE	SMALL	SMALL to MODERATE
Ecology	SMALL to MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to MODERATE
Water use and quality	SMALL	SMALL	SMALL	SMALL
Socioeconomics	LARGE Beneficial	LARGE Beneficial	MODERATE Beneficial	MODERATE Beneficial
Aesthetics	SMALL	MODERATE	SMALL	SMALL to MODERATE
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Environmental justice	LARGE Beneficial	LARGE Beneficial	MODERATE Beneficial	MODERATE Beneficial

8.3.1 Heat-Dissipation Systems

The purpose of the plant cooling system is to dissipate energy to the environment. The various cooling system options differ in how the energy transfer takes place, and therefore have different environmental impacts. SERI considered seven heat-dissipation alternatives in its environmental report (SERI 2005):

- Once-through cooling
- Wet mechanical draft cooling towers
- Wet natural draft cooling towers
- Wet-dry cooling towers

- Dry cooling towers
- Cooling pond
- Spray canals.

Of these systems, SERI determined that the only alternatives suitable for the Grand Gulf ESP site were wet mechanical draft towers, wet natural draft towers, and wet-dry cooling towers. However, SERI only included wet natural draft and wet mechanical draft cooling towers in its PPE.

SERI eliminated dry cooling towers, cooling pond, and spray canals from consideration because it determined that the land requirements for these systems made them unsuitable for the site. SERI eliminated once-through cooling because of the aquatic impacts associated with the large volumes of water that would need to be withdrawn from the Mississippi River and subsequently returned to the river at an elevated temperature.

The Grand Gulf site includes approximately 850 ha (2100 ac) in a rural setting along the Mississippi River. Lowlands below the bluffs make up about half of the site. The lowlands include Hamilton and Gin lakes and wetlands that are subject to frequent flooding from the river. Therefore, the staff determined that the lowlands would be less suitable for development than the upland area.

Approximately 60 ha (150 ac) of the uplands area is committed to the existing GGNS Unit 1 facility. Some additional wetlands, particularly along the Stream A and Stream B corridors, occur above the bluffs. The staff determined that the ESP site was unsuitable for cooling pond or spray canal heat-dissipation designs based on the limited area of the site.

The staff also concluded that the Mississippi River is not a suitable source for a once-through cooling system. EPA regulations (40 CFR Part 125, Subpart I) issued in 2001 contain requirements applicable to cooling water intake structures for new facilities under Section 316(b) of the Clean Water Act that make it very difficult for large new generating plants to use once-through cooling. In addition, the staff determined that high sediment concentrations in the Mississippi River may require extensive large-scale water treatment, and that some adverse impacts would occur during the construction and maintenance activities associated with intake and discharge structures and buried piping.

Dry cooling tower systems use either a natural or a mechanical air draft to transfer heat from the condenser tubes to the air. Since dry cooling uses essentially no water, water use is bounded by the wet-tower designs. Although noise from the fans in a dry tower or a wet-dry tower would likely be greater than for a mechanical draft system, the staff believes that these impacts would be minimal in a rural environment such as the Grand Gulf ESP site. In the environmental report, SERI determined that dry cooling for the ESP site would not be suitable because insufficient land would be available (SERI 2005). However, even using SERI's high estimate of the land requirements for the dry cooling alternative, land requirements would only be approximately 65 ha (160 ac), which is considerably less than the available area. Nevertheless, the staff concludes that dry cooling tower systems would not be suitable for the ESP site for the reasons discussed by EPA in the preamble to EPA's final rule on NPDES regulations addressing cooling water intake structures for new facilities (66 FR 65256). EPA determined that dry cooling is not the best technology available for minimizing adverse environmental impacts in part because the technology of dry cooling carries costs that are sufficient to pose a barrier to entry to the marketplace for some projected new facilities, and dry cooling technology has some detrimental effects on electricity production by reducing the energy efficiency of steam turbines. Therefore, the staff concludes that dry cooling tower systems should only be considered if water supply is an issue. Water supply is not an issue at the Grand Gulf ESP site.

In conventional closed-cycle recirculating wet cooling towers, cooling water that has been used to cool the condensers is pumped to the top of a recirculating cooling tower; as the heated water falls, it cools through an evaporative process and warm, moist air rises out of the tower, often creating a vapor plume. The GEIS for license renewal has a summary of the impacts of wet cooling towers on terrestrial resources (NRC 1996). The impacts identified in the GEIS include visible plumes; noise; icing; deposition of salts, biocides, and microorganisms in the vicinity of towers; avian mortality from collisions of birds with towers; and the visual impacts of the towers themselves. Some of these impacts (for example, icing and deposition of salts) are associated with low, mechanical draft cooling towers, while others (such as avian mortality and visual impacts) are associated with natural draft towers.

Wet-dry cooling towers employ both a wet section and dry section and reduce or eliminate the visible plumes associated with wet cooling towers. Water use for the wet-dry cooling tower alternative is bounded by mechanical and natural draft wet cooling towers. Compared to wet cooling towers, less evaporation, makeup water, and blowdown are involved in the wet-dry cooling process, thus reducing water-related impacts. However, the disadvantages of dry cooling discussed in the EPA preamble to the final NPDES rule (66 FR 65256) apply to the dry cooling portion of the heat-dissipation process. The dry cooling process is not as efficient as the wet cooling process because it requires the movement of a large amount of air through the heat exchanger to achieve the necessary cooling. This results in less net electrical power for distribution.

Water supply is not an issue at the Grand Gulf ESP site. Based on the NRC staff's independent review, the staff concludes that wet mechanical draft cooling towers and wet natural draft cooling towers are suitable for the site. The specific cooling system design for one or more new nuclear units or units at the Grand Gulf ESP site has not been selected; therefore, system design alternatives would be discussed at the CP or COL stage if an application were submitted to build a new plant at the site.

8.3.2 Circulating Water Systems

In a once-through cooling process, water is withdrawn from a cooling water source, passed through the condenser once, and then returned to the receiving water body. In a closed-loop system, heat transferred from the condenser to the circulating water is dissipated through auxiliary cooling facilities, after which the cooled water is recirculated to the condenser. This recirculation step means that much less water needs to be withdrawn from the water source than for a once-through cooling system with the same heat rejection capacity. Alternative intake, discharge, water supply, and water treatment systems for a closed-loop design at the Grand Gulf ESP site are discussed below.

8.3.2.1 Intake Systems

GGNS Unit 1 uses multiple radial collector wells located next to the Mississippi River. The wells pump from the alluvial aquifer to provide makeup water for the natural and mechanical draft cooling system used for Unit 1. SERI states in its environmental report that a similar arrangement of collector wells drawing water from the alluvial aquifer for a new power plant located at the Grand Gulf ESP site could not be supported by the aquifer (SERI 2005). Therefore, SERI states that, for a new plant, makeup water for the heat-dissipation system and the circulating water system would be withdrawn directly from the Mississippi River through a shoreline embayment and intake constructed on the bank of the river (SERI 2005).

Two alternative types of river intakes were considered by SERI in its environmental report. One alternative would involve a direct intake from the river with a structure located on the riverbed and a pipeline connecting it to the bank. The Mississippi River is very active with vast amounts of sediment moving along the riverbed making it difficult to maintain structures located on the riverbed. Additionally, the Mississippi River is a critical transportation corridor and any in-stream construction and maintenance activities must consider possible impacts on river traffic. The second alternative would involve a channel directing water to the intake structure on the shoreline. The staff found no basis to suggest that these two water intake alternatives would be environmentally preferable to SERI's proposed intake system.

8.3.2.2 Discharge Systems

GGNS Unit 1 uses a cooling tower/circulating water system. The blowdown from the cooling tower is discharged to the Mississippi River through the existing barge slip embayment. SERI states that the thermal effluent from a new facility would also be released to the river through a new outfall structure that would be located downstream of the existing outfall (SERI 2005).

The staff evaluated a shoreline diffuser outfall and a submerged single-point discharge. The shoreline diffuser would result in a larger plume; however, its impact on the Mississippi River would be localized and small as discussed in Section 5.3.2. For a submerged port-diffuser located beneath the water surface, the buoyant jet would entrain ambient water as it rises to the surface, thus enhancing mixing. However, a submerged outfall could interfere with traffic on the river, would be more difficult to construct, and may require maintenance dredging. The shoreline discharge proposed by SERI would avoid dredging and in-stream construction. The staff found no basis to suggest that the two discharge alternatives would be environmentally preferable to SERI's proposed discharge system.

8.3.2.3 Water Supply

A source of makeup water at the ESP site would be needed to offset the continuous loss of water from evaporation, drift, and blowdown. The two sources of water on or near the Grand Gulf ESP site that could provide an adequate volume of makeup water are the Mississippi River and wells in the alluvial aquifer. Because of the hydraulic connection between the alluvial aquifer and the river, the wells would effectively withdraw water from the river. The staff also found that the Catahoula aquifer would not provide adequate water supply for any but the dry cooling heat-dissipation system alternative. The staff did not identify any other environmentally preferable water supply.

8.3.2.4 Water Treatment

At this stage, the final design of the various water systems for a new nuclear plant located at the Grand Gulf ESP site has not been specified. The water treatment requirements and water system effluents are not known. However, all chemical and thermal discharges from the water treatment systems, regardless of the methods chosen, would be regulated by the MDEQ through the NPDES process.

8.4 Region of Interest and Alternative Site Selection Process

NRC regulations require that the environmental report submitted in conjunction with an application for an ESP include an evaluation of alternative sites to determine whether any obviously superior alternative exists to the site proposed (10 CFR 52.17(a)(2)). This section includes a discussion of Entergy's ROI for possible siting of a new nuclear power plant and Entergy's alternative site selection process.

SERI is the applicant for an ESP at the Grand Gulf site. SERI is a subsidiary of Entergy Corporation and has the exclusive rights to develop the proposed Grand Gulf ESP site property outside the existing power plant and support facilities (SERI 2005). Entergy Nuclear, a division of Entergy Corporation, conducted the alternative site selection process for the Grand Gulf ESP application.

8.4.1 Applicant's Region of Interest

Generally, the ROI is the geographic area considered in searching for candidate ESP sites (NRC 2000). More specifically, the ROI is

> The geographical area initially considered in the site selection process. This area may represent the applicant's system, the power pool or area within which the applicant's planning studies are based, or the regional reliability council or the appropriate subregion or area of the reliability council (NRC 1976).

Entergy Nuclear selected its ROI for examining potential ESP sites as the locations of the seven existing Entergy sites with operating nuclear power plants licensed by the NRC (SERI 2005) at the time of its application for an ESP. These seven sites are

- Arkansas Nuclear One, located approximately 10 km (6 mi) west of Russellville, Arkansas
- Grand Gulf Nuclear Station, located approximately 40 km (25 mi) south of Vicksburg, Mississippi
- James A. FitzPatrick Nuclear Power Plant, located approximately 13 km (8 mi) northeast of Oswego, New York
- Indian Point Energy Center, located approximately 39 km (24 mi) north of New York City, New York
- Pilgrim Nuclear Station, located approximately 6 km (4 mi) southeast of Plymouth, Massachusetts
- River Bend Station, located approximately 39 km (24 mi) northwest of Baton Rouge, Louisiana
- Waterford-3, located approximately 32 km (20 mi) west of New Orleans, Louisiana.

Entergy Nuclear's ROI was limited to the preceding seven sites for the following reasons (SERI 2005):

- NRC has approved the sites for nuclear plant construction and operation.
- Site infrastructures appropriate for nuclear plant operation are in place.
- Site characterization data have been collected and are available.
- Access to the sites is readily available.
- Programs, procedures, and arrangements have been established and are in place with State and local governmental agencies.
- Entergy liaisons with the local communities exist.
- Operational impact of the existing nuclear plants is documented.
- Site records document the presence of any radiological and non-radiological spills and contamination events on the sites.
- The sites and related facilities are controlled by Entergy.

Environmental review guidance promulgated by NRC for alternative nuclear plant sites recognizes there will be special cases for which the proposed site was not selected on the basis of a systematic site selection process (NRC 2000). One example cited in the guidance is when an existing nuclear power plant site is proposed for the siting of a new nuclear plant.

The staff concludes that the criteria used to identify the ROI used in the ESP application were reasonable for consideration and analysis of potential ESP sites.

8.4.2 Applicant's Alternative Site Selection Process

Entergy Nuclear's process for selection of a preferred ESP site consisted of the following steps:

- An ROI was established. Based on the ROI, a set of potential sites was identified for consideration in the selection process.
- The initial set of sites was screened, using Entergy Nuclear's criteria, to further refine it to a listing of candidate sites warranting more detailed evaluation.

- Candidate sites were subjected to more detailed evaluation, using Entergy Nuclear's criteria, to arrive at a preferred site for an ESP application (SERI 2005).

8.4.2.1 Screening of Seven Sites to Four

First, Entergy Nuclear eliminated the Indian Point Energy Center site from further review because the population density in the vicinity of the site exceeds 500 persons per square mile (SERI 2005). Entergy Nuclear conducted an initial screening of the remaining six sites to reduce the potential ESP sites to a smaller subset of sites for detailed review. In conducting the initial screening, Entergy Nuclear (2001) used the screening criteria, the bases for screening criteria, and relative weighting factors for each criterion shown in Table 8-5.

The relative weighting factors were determined by Entergy Nuclear. Weights were assigned on a scale of 1 to 10 with 10 being most important and 1 least important. Each site was also qualitatively assigned a score by Entergy Nuclear for each criterion using a scale of 1 to 5 with 5 representing most favorable and 1 least favorable. After application of the scores and weighting factors, Entergy Nuclear ranked the six potential ESP sites in the following order of preference (Entergy Nuclear 2001):

(1) Grand Gulf Nuclear Station
(2) River Bend Station
(3) James A. FitzPatrick Nuclear Power Plant
(4) Waterford-3
(5) Arkansas Nuclear One
(6) Pilgrim Nuclear Station.

At this stage, Entergy Nuclear eliminated the Waterford-3 and Arkansas Nuclear One sites from further consideration because it wished "to gain ESP experience in a variety of technical and public acceptance environments, as well as to capitalize on two separate power markets" (SERI 2004a). Further consideration of the Pilgrim site, even though it had the lowest weighted score of the six sites, was driven by Entergy Nuclear's interest in ensuring regional diversity.

Entergy Nuclear determined that both the Waterford-3 and Arkansas Nuclear One sites are viable for new nuclear plants, but the two sites are currently viewed by Entergy Nuclear as less suitable than Grand Gulf and River Bend (Entergy Nuclear 2001).

Table 8-5. Initial Screening Criteria for Selecting an Early Site Permit Site

Initial Screening Criteria	Basis for Screening Criteria	Relative Weighting Factor
Seismic Evaluation	Probability of ground acceleration greater than 0.3 g	7.2
Demographic Changes	Total population in nearby areas from the year 2000 U.S. Census	6.1
Emergency Planning	Status of existing emergency plans	5.6
Exclusion Area	Available room for new nuclear generating units	6.1
Transmission Access	Potential for achieving required injection capacity and the cost of providing the capacity	8.2
Power Pricing	Expected price for power and ease of delivering power to the anticipated load center	9.1
Water Availability	Extent and ease to which water for plant use is available	7.1
Permitting/Licensing Status	Relative ease to which required permits and licenses for a new nuclear plant can be obtained	6.4
Plans for Existing Units	Compatibility of Entergy plans for existing nuclear units with new nuclear units	3.0
Spent Fuel Storage	Availability of onsite spent fuel storage	2.6
Public Acceptance	Perceived level of public acceptance of a new nuclear plant at each site	6.6

Source: Entergy Nuclear 2001

Given Entergy Nuclear's interest in ensuring regional diversity (i.e., sites in its two power markets), the staff concluded that the down-selection of the Waterford-3 and Arkansas Nuclear One sites is reasonable. The staff continued to review the Pilgrim alternative site because it permits an assessment of regional diversity. In the end, had there been concerns with the overall impacts of the preferred site, the staff would have reconsidered this step.

8.4.2.2 Screening of Four Sites to One

For the final screening of sites from four to one preferred site, Entergy Nuclear used a similar approach to the initial screening. Screening criteria and weighting factors were developed. Relative weights and scores for each criterion for each site were assigned by Entergy Nuclear (Entergy Nuclear 2001). In conducting the final screening, Entergy Nuclear used the screening criteria and relative weighting factors for each criterion shown in Table 8-6.

Table 8-6. Final Screening Criteria for Selecting an Early Site Permit Site

Final Screening Criteria	Elements of the Screening Criteria	Weighting Factor
Geology/Seismology	Vibratory ground motion, capable tectonic structures or sources, surface faulting and deformation, geologic hazards, and soil stability	3.77
Cooling System Requirements	Quantity of cooling water available and the ambient air temperature	3.27
Flooding	Flooding potential at the site	2.4
Nearby Hazardous Land Uses	NRC reactor site criteria in 10 CFR Part 100 and existing and projected hazards within 8 km (5 mi) of the site	3.35
Extreme Weather Conditions	Plant parameter envelope criteria regarding tornadoes, wind, and precipitation	2.36
Accident Effect-Related	NRC population criteria in 10 CFR 100.21, population density guidance in NRC Regulatory Guide 4.7 (NRC 1998), emergency planning characteristics, and short-term atmospheric dispersion characteristics	4.09
Surface-Water Radionuclide Pathway	Potential liquid pathway dose consequences including dilution capacity, existing radionuclides in the stream, and proximity to downstream consumptive users	2.5
Groundwater Radionuclide Pathway	Vulnerability of shallow groundwater resources to potential contamination	2.55
Air Radionuclide Pathway	Radionuclide pathways as a function of topographic effects and atmospheric dispersion	2.5
Air-Food Ingestion Pathway	Emission of radionuclides into the food chain via local crops and pastures	2.5

Table 8-6. (contd)

Final Screening Criteria	Elements of the Screening Criteria	Weighting Factor
Surface-Water-Food Radionuclide Pathway	Use of irrigation water by downstream users as a potential pathway for exposure	2.41
Transportation Safety	Increase of highway traffic safety risk as a result of fogging and ice caused by cooling towers	2.14
Disruption of Important Aquatic and Marine Species or Habitats	Construction-related impacts on aquatic and marine ecology	2.64
Bottom Sediment Disruption Effects	Short-term impacts on aquatic and marine resources resulting from dredging activities during construction	2.14
Disruption of Important Plant and Animal Species	Construction-related impacts on important species, their habitats, and terrestrial ecology	3.18
Dewatering Effect on Adjacent Wetlands	Impacts of construction related dewatering activities on area wetlands	2.77
Thermal Discharge Effects	Impacts of thermal discharges on migratory species, other important species and habitat, and water quality	3.64
Entrainment and Impingement Effects	Entrainment and impingement effect on marine organisms resulting from cooling water withdrawal and screening	3.23
Dredging and Disposal Effects	Environmental impacts related to maintenance dredging at the cooling water intake structure	2.36
Cooling Tower Drift Effects on Surrounding Areas	Impacts related to the emission and downwind deposition of cooling water salts	2.36
Socioeconomics	Socioeconomic impacts during construction of new nuclear power plants	2.0
Environmental Justice	Possible disproportionate adverse impacts on minority and low-income populations	1.95
Water Supply	Raw water consumption cost	3.7
Pumping Distance	Cost of construction associated with supplying a primary water source for the plant	3.05
Flood Mitigation	Cost of flood mitigation features and insurance	2.9

Table 8-6. (contd)

Final Screening Criteria	Elements of the Screening Criteria	Weighting Factor
Vibratory Ground Motion	Incremental construction cost to account for vibratory ground motion	4.0
Soil Stability	Incremental construction cost to account for soil stability	3.4
Railroad Access	Cost of constructing railroad spur	2.6
Highway Access	Cost of constructing roads to from plant site to nearby highway	2.8
Barge Access	Cost of constructing barge terminal	2.85
Transmission	Cost of transmission line to connect site to grid and necessary system upgrades	4.8
Topography	Land preparation cost related to the topography	2.55
Land Rights	Cost of acquiring land area and relocating existing structures	2.75
Labor Rates	Relative cost of labor	3.3

Source: Entergy Nuclear 2001

After applying the scores and weighting factors, Entergy Nuclear ranked the four potential ESP sites in the following order of preference (Entergy Nuclear 2001):

(1) Grand Gulf Nuclear Station
(2) James A. FitzPatrick Nuclear Power Plant
(3) River Bend Station
(4) Pilgrim Nuclear Station.

Accordingly, SERI submitted the ESP application for the Grand Gulf site as the preferred site. The staff concluded that SERI's overall site selection process for alternative sites is reasonable and the identification of the Grand Gulf ESP site is consistent with SERI's approach.

8.5 Evaluation of Alternative Sites

The three alternative sites examined in detail in this section are the River Bend Station near Baton Rouge, Louisiana; Pilgrim Nuclear Station near Plymouth, Massachusetts; and

James A. FitzPatrick Nuclear Power Plant near Oswego, New York. All three of the alternative sites have existing nuclear power plants that are owned and operated by Entergy Corporation. The staff visited each of the three alternative sites as well as the proposed Grand Gulf ESP site, and collected additional reconnaissance-level information about the alternative sites.

8.5.1 Evaluation of the River Bend Station Site

This section covers the staff's evaluation of the potential environmental impact of siting new nuclear units within the scope of the SERI PPE at the River Bend Station (River Bend) site.

8.5.1.1 Land Use Including Site and Transmission Line Rights-of-Way

Site and Vicinity

The River Bend site is located on over 1200 ha (3000 ac) along the east bank of the Mississippi River, about 6 km (4 mi) south of the town of St. Francisville, Louisiana. The area around the site and the vicinity remains largely agricultural with significant crop production and some industrial forestry. Similar in many respects to the Grand Gulf site, there is adequate land area available within the existing site boundary to house a generating facility based on the PPE. Because the potential site of the ESP facility would use a portion of the existing River Bend site, no land would be preempted for additional facilities built at this site (SERI 2005). The types of impacts of new facility construction and operations (i.e., physical, ecological, social, and radiological impacts) are likely to be similar to those expected for the Grand Gulf ESP site. The River Bend site is not affected by the Coastal Zone Management Act of 1972, as amended. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the land-use impacts on the site and vicinity of construction and operation are expected to be SMALL.

Transmission Line Rights-of-Way

Five transmission lines exit the River Bend site in three separate rights-of-way. One 500-kV line runs due east from the site crossing mostly agricultural and forested land for 43 km (27 mi) to a substation near the junction of State Highways 959 and 63 (McKnight Crossing). Another 500-kV line runs south-southwest from the site, crosses the Mississippi River, and then runs across agricultural and forested land 46.9 km (29.3 mi) to a substation near Rosedale, Louisiana. Three lines (230 kV) run south-southeast for 18.1 km (11.3 mi) paralleling the Mississippi River and U.S. Highway 61, and then across lowlands and swamps to a substation near Irene, Louisiana. None of these transmission line rights-of-way cross any known protected land designations or special land uses. Section 3.3 details the regulatory procedure required to link new large generation to the grid. The issues that could result in potential impacts from construction and operations in these transmission line rights-of-way (i.e., physical and ecological impacts) would be similar to those land-use impacts for construction and operations in the transmission line rights-of-way associated with the Grand Gulf ESP site. Therefore, the staff concludes that the land-use impacts of transmission system construction and continued operation would be SMALL.

8.5.1.2 Water Use and Quality

Water Use

The River Bend site is located adjacent to the Mississippi River downstream of the Grand Gulf ESP site where flows, rainfall, and floodplain characteristics are similar. Construction activities for a new nuclear unit or units at River Bend would have similar water usage impacts (i.e., physical and ecological impacts) as at the Grand Gulf ESP site. During operation, the consumptive use of water from the proposed mechanical draft cooling towers would be a very small fraction of the supply available in the river, even during record low flows. Therefore, the staff concludes that the impacts on water use and water supply at the River Bend site would be SMALL.

Water Quality

Construction activities of a new nuclear unit or units at the River Bend site would follow best management practices and have similar water-quality impacts as the Grand Gulf ESP site, and would be bounded by the operational impacts. The additional heat from blowdown water could be commingled with the discharge from the existing River Bend Station. This would increase the size of the thermal plume that currently exists. Thermal and chemical discharges to the Mississippi River would be regulated by the Louisiana Department of Environmental Quality via an NPDES permit issued to protect the environment. Since the combined discharge represents a very small fraction of the flow in the Mississippi River, the staff concludes that the impacts to water quality at the River Bend site would be SMALL.

8.5.1.3 Terrestrial Resources Including Endangered Species

Construction Impacts

Three general vegetation types are onsite: upland forests, bottomland hardwoods, and meadows and pastures. Following construction of the existing River Bend plant, remaining land cover for the three vegetation types were upland forests (347 ha (858 ac)), bottomland hardwoods (282 ha (697 ac)), and meadows and pastures (105 ha (259 ac)) (AEC 1974a), totaling 734 ha (1814 ac).

Construction of a new generating facility would likely remove the three vegetation types listed above in similar proportions as did construction of the existing units at the River Bend site, which were upland hardwood forests, 63.3 percent; bottomland hardwoods, 3.0 percent; and meadows and pastures, 33.7 percent (AEC 1974a). SERI (2005) denotes the total area that would be disturbed by construction of the Grand Gulf ESP facility to be 162 ha (400 ac). In Figure 2-5, however, SERI (2005) denotes the disturbed area to be 160 ha (395 ac). Construction of a new facility at the River Bend site would disturb roughly the same area. Of the 160 ha (395 ac), 101 ha (250 ac) of upland hardwood forest, 5 ha (12 ac) of bottomland hardwood forest, and 54 ha (133 ac) of meadows and pastures would be lost. These values account for 29, 2, and 51 percent of the upland forest, bottomland hardwood forest, and meadows and pastures remaining on the River Bend site. The combined loss of upland and bottomland hardwood forest would be about 106 ha (262 ac), or approximately 17 percent of the total available onsite, constituting a modest loss of forest habitat.

The potential impacts from construction, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated using standard industrial procedures and best management practices. Standard practices, such as silt fences to control sedimentation and water sprays to limit dust generation, would protect wetlands and other ecological resources in the site vicinity.

Five transmission lines in three separate rights-of-way, extending over a total length of 109 km (68 mi) (Section 8.5.1.1) and covering 417 ha (1031 ac) (NRC 1996), currently serve the River Bend Station. Land cover along these lines consists of pasture (43 percent), forest (38 percent), crops (15 percent), residential (2 percent), and water (2 percent) (AEC 1974a). It is assumed that these transmission lines would not have the capacity to carry the power generated by a new facility and that a transmission system upgrade, including new transmission lines and an additional right-of-way, would be needed. It is assumed that any additional right-of-way would be an expansion of the existing right-of-way (see Section 4.4.12). Consequently, a modest amount of forest habitat, up to 159 ha (392 ac), could be lost due to the expansion.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes the impacts on terrestrial ecological resources from construction of a new generating facility at the River Bend site and construction associated with possible expansion of the existing River Bend transmission line rights-of-way would be MODERATE.

Threatened and Endangered Species

The only Federally listed threatened or endangered terrestrial species that may occur in the River Bend area is the threatened Louisiana black bear (*Ursus americanus luteolus*) (FWS 2004a). The River Bend site is located adjacent to the Atchaflaya River Basin breeding sub-population of Louisiana black bears (FWS 1995). The proposed Atchaflaya River Basin Floodway critical habitat unit is located at least 16 km (10 mi) to the west of the River Bend site.

No occurrences of the bear are known within 16 km (10 mi) of the site (Table 8-7) (LNHP 2004a). Therefore, it appears unlikely the subspecies occurs on the River Bend site (SERI 2004d) and so would not be impacted by construction or operation of a new generating facility. None of the five River Bend transmission lines are located within 16 km (10 mi) of the Atchaflaya River Basin Floodway critical habitat unit. Consequently, critical habitat would not be impacted by expansion of the existing transmission line rights-of-way.

Table 8-7. Terrestrial Federally and State-Listed Species Occurring in the Vicinity of the River Bend Site

Scientific Name	Common Name	Status(a)	Distance from the River Bend Site(b)	Source
Mammals				
Mustela frenata	long-tailed weasel	S2-S4	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Sorex longirostris	southeastern shrew	S2-S3	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Spilogale putorius	eastern spotted skunk	S1	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Ursus americanus luteolus	Louisiana black bear	FT/S2	>10 mi (16 km)	FWS 2004a; LNHP 2004a
Plants				
Actaea pachypoda	white baneberry	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Antennaria solitaria	single-head pussytoes	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Circaea lutetiana canadensis	intermediate enchanter's nightshade	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Deparia acrostichoides	silvery glade fern	S2	<3.2 km (2 mi)	LNHP 2004a
Dichanthelium clandestinum	deer-tongue witchgrass	S2	<3.2 km (2 mi)	LNHP 2004a
Dryopteris ludoviciana	southern shield wood-fern	S1	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Eleocharis radicans	rooted spike-rush	S1	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Magnolia pyramidata	pyramid magnolia	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Mimulus ringens	square-stemmed monkey-flower	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a

Table 8-7. (contd)

Scientific Name	Common Name	Status[(a)]	Distance from the River Bend Site[(b)]	Source
Pachysandra procumbens	Allegheny-spurge	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Physalis carpenteri	carpenter's ground-cherry	S1	<3.2 km (2 mi)	LNHP 2004a
Stewartia malacodendron	silky camelia	S2-S3	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Triphora trianthophora	nodding pogonia	S2	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service under the Endangered Species Act, FT = Federal threatened (FWS 2004a). State status rankings developed by the Louisiana Natural Heritage Program, S1 = critically imperiled, S2 = imperiled, S3 = rare, S4 = secure (LNHP 2004a). Hyphenated state status ranks indicate a range in the status of the species based on insufficient data to make a determination.
(b) Distances provided by LNHP (2004a).

Three State-listed imperiled or critically imperiled terrestrial animal species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the River Bend site: the long-tailed weasel (*Mustela frenata*), southeastern shrew (*Sorex longirostris*), and eastern spotted skunk (*Spilogale putorius*) (Table 8-7) (LNHP 2004a). The long-tailed weasel is found in a wide variety of habitats, including farmland, woodlands, and swamps, with areas near water being preferred (Linzey and Brecht 2002a). The southeastern shrew occurs in a variety of habitats from fields to forests (Linzey and Brecht 2002b), as does the eastern spotted skunk (Pennington 2002). These three species are habitat generalists and could occur on the River Bend site and along its transmission line rights-of-way. Therefore, they could potentially be affected by construction of a new generating facility at the River Bend site and possible expansion of the existing transmission line rights-of-way.

There are three State-listed imperiled or critically imperiled terrestrial plant species known to occur within 3.2 km (2 mi) of the River Bend site: silvery glade fern (*Deparia acrostichoides*), deer-tongue witchgrass (*Dichanthelium clandestinum*), and carpenter's ground-cherry (*Physalis carpenteri*) (Table 8-7) (LNHP 2004a). Silvery glade fern occurs in damp woods (FNA 2004a). Deer-tongue witchgrass occurs in moist soils of woodland edges and clearings (Ernst Conservation Seeds 2004). Carpenter's ground-cherry occurs in mixed hardwood-loblolly pine (*Pinus taeda*) woods, southern mesophytic woods, and hardwood slope forest (LNHP 2004b). These three species are habitat generalists that could occur on the River Bend site and along its transmission line rights-of-way. Consequently, they could be adversely affected by construction of a new generating facility on the River Bend site and by possible expansion of the existing transmission line rights-of-way.

Ten additional State-listed imperiled or critically imperiled terrestrial plant species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the River Bend site: white baneberry (*Actaea pachypoda*), single-head pussytoes (*Antennaria solitaria*), intermediate enchanter's nightshade (*Circaea lutetiana canadensis*), southern shield wood-fern (*Dryopteris ludoviciana*), rooted spike-rush (*Eleocharis radicans*), pyramid magnolia (*Magnolia pyramidata*), square-stemmed monkey-flower (*Mimulus ringens*), Allegheny-spurge (*Pachysandra procumbens*), silky camelia (*Stewartia malacodendron*), and nodding pogonia (*Triphora trianthophora*) (Table 8-7) (LNHP 2004a). White baneberry occurs in deciduous forests (FNA 2004b). Single-head pussytoes grows in woods and woodland clearings (NearActica 2004). Intermediate enchanter's nightshade occurs in deciduous woodlands (Verburg 1998). Southern shield wood-fern occurs in swamps and wet woods (FNA 2004c). Rooted spike-rush occurs in stream alluvium and around lake margins, meadows, seeps, and bogs (FNA 2004d). Pyramid magnolia occurs in woods and on river bluffs (FNA 2004e). Square-stemmed monkey-flower occurs along stream banks, lake margins, and wet meadows (Missouriplants 2004). Allegheny-spurge occurs in riparian forest habitat (SERPIN 2004). Silky camelia inhabits the understory of wooded bluffs and ravine slopes and the open edges of transition zones (ecotones) between sand hills and creek swamps (GSRCORP 2004). Nodding pogonia occurs on rotten logs and in rich humus and leaf mold of low hammocks, hardwood and coniferous forests, woods along streams, edges of swamps, floodplain forests, and mountain slopes (LNHP 2004c). These ten species are habitat generalists that could occur on the River Bend site and along its transmission line rights-of-way. Consequently, they could be affected by construction of a new generating facility on the River Bend site and by possible expansion of the existing transmission line rights-of-way.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on threatened and endangered species from construction of a new generating facility on the River Bend site and possible expansion of the existing transmission line rights-of-way could range from SMALL to MODERATE.

Operation Impacts

Impacts on terrestrial resources that may result from operation of one or more new nuclear units at the River Bend site include those associated with cooling towers and transmission lines. The River Bend plant currently employs cooling towers, and more cooling towers would be added for one or more new nuclear units. The impacts of cooling tower drift and bird collisions for existing nuclear power plants were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with multiple cooling towers of various types. The staff is not aware of any information that would cause it to modify its earlier conclusion. On this basis, for the purposes of consideration of alternative sites, the impacts of cooling tower drift and bird collisions with cooling towers resulting from operation of one or more new nuclear units at the River Bend site would be negligible.

For both natural and mechanical draft cooling towers, the noise level from cooling tower operation is anticipated to be 55 decibels (dBA) at 300 m (1000 ft) (SERI 2005). The noise level for dry cooling towers is somewhat higher. However, these noise levels are all well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the River Bend site would not be likely to disturb wildlife beyond 300 m (1000 ft) from the source. Further, impacts within this distance, if any, would be considered negligible owing to the large expanses of open habitat available into which mobile wildlife species could move if disturbed. Consequently, the impacts of cooling tower noise on wildlife from operation of one or more new nuclear units at the River Bend site would be minimal.

The cooling towers from one or more new nuclear units at the River Bend site would withdraw a small quantity of water relative to Mississippi River flows, and would discharge water back into the river at a temperature greater than ambient conditions. The amount of water withdrawn from the Mississippi River would represent only about 0.2 percent of the total flow and would not detectably alter shoreline habitat.

The impacts usually associated with transmission line operation consist of bird collisions with transmission lines. The staff assumes that the addition of new lines for expansion of the transmission system for one or more new nuclear units at the River Bend site would present few new opportunities for bird collisions and that no measurable reduction in local bird populations would result. The issue of bird collisions with transmission lines was evaluated previously in the GEIS (NRC 1996) and was found to be small for all facilities, including those with multiple transmission line rights-of-way with various numbers of transmission lines. Based on the above rationale and the associated conclusions presented in GEIS (NRC 1996), the effects on bird collisions of transmission line operation for one or more new nuclear units at the River Bend site would be negligible.

The impacts usually associated with transmission line right-of-way maintenance (cutting and herbicide application) consist of erosion/siltation and disturbance of wildlife and wildlife habitat, and similar impacts where rights-of-way cross floodplains and wetlands. The staff assumes that right-of-way maintenance would be conducted similar to current operations, only over a wider area. The effects of right-of-way maintenance were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with transmission line rights-of-way of various widths. The staff is not aware of any new information that would cause it to modify its earlier conclusion. Therefore, general wildlife and wildlife habitat would be expected to be minimally affected by right-of-way maintenance in transmission line rights-of-way expanded for one or more new nuclear units at the River Bend site.

The staff reviewed the operation of one or more nuclear units at the River Bend site, including the associated heat-dissipation system and transmission line operation and right-of-way maintenance. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts of operation of one or more nuclear units at the River Bend site on terrestrial resources and threatened and endangered species would be SMALL.

8.5.1.4 Aquatic Resources Including Endangered Species

Construction and Operation Impacts

The aquatic resources at the River Bend site are associated with the Mississippi River and the watershed of Grants Bayou. The station is located on a terrace above the river's floodplain at approximately River Mile 262. Other water resources on the site within Grants Bayou watershed include Alexander Creek, West Creek, Alligator Bayou, and 19 small farm ponds, including Grassy Lake and a constructed wildlife management lake (AEC 1974a; NRC 1985).

The River Bend Station uses a closed-cycle cooling system that draws water from the Mississippi River and discharges it back into the river at a downstream location. The intake and discharge systems for the existing River Bend Station would be used for operation of a new facility, and minimal construction activities are anticipated in upgrading these facilities to handle discharges from the new unit(s). Any construction impacts, such as erosion and sedimentation into the water resources, could be mitigated using standard industrial procedures and best management practices.

Operation of the new unit(s) would have minimal impacts on the aquatic resources of the Mississippi River. Water withdrawn from the river for the cooling system would be a very small fraction of the supply available in the river, even during record low flows. Because of the use of closed-cycle cooling, incremental impacts from entrainment, impingement, and heat shock on aquatic resources would be negligible. The additional heat from blowdown water would be commingled with the discharge from the other units, resulting in a greater thermal plume in the area of the discharge.

The other water resources at the River Bend site are not anticipated to be affected by construction and operation of a new unit or units. West Creek was rerouted when the current facility was built and is used for collection of runoff water. Additional facilities at the site would increase runoff into the creek; however, the aquatic resources in this concrete channel are of a poor quality and have adapted to the changes in water flow from precipitation events. Impacts on Alligator Bayou would not be anticipated because the river access road connecting a new generation facility to the Mississippi River would not be changed.

The staff concludes that the overall impacts on aquatic resources from construction and operation of one or more new nuclear units and associated cooling towers at the River Bend site would be SMALL.

Threatened and Endangered Species

Table 8-8 lists the Federally and State-listed threatened and endangered aquatic species within 16 km (10 mi) of the River Bend site. The only Federally listed threatened or endangered aquatic species that could occur in the River Bend area is the endangered pallid sturgeon (*Scaphirhynchus albus*) (FWS 2004a). The River Bend site is adjacent to the shores of the Mississippi River within the known range of the pallid sturgeon. The species was designated as endangered throughout its entire range in 1990 (55 FR 36641; FWS 1993). Pallid sturgeon have not been caught in the vicinity of the River Bend site (River Mile 262). The closest and most recent catches have been at River Miles 229 and 314 (LDOTD 2003).

There are two State-listed imperiled or rare species that are known to occur within 16 km (10 mi) of the River Bend site. The bluntface shiner (*Cyprinella camura*) is an imperiled or rare fish found within the tributaries of the Mississippi River. The Louisiana Department of Wildlife and Fisheries lists the bluntface shiner as known to occur within 3.2 km (2 mi) of the River Bend site (LNHP 2004a); however, past studies of the aquatic resources from the onsite tributaries have not reported the fish (AEC 1974a; NRC 1985). The rainbow darter (*Etheostoma caeruleum*) is an imperiled or rare fish found within 16 km (10 mi) of the River Bend site. The rainbow darter is found in moderately swift runs and riffles of shallow tributaries of the Mississippi River. Neither the bluntface shiner nor the rainbow darter have been found on the River Bend site during past sampling programs (AEC 1974a; NRC 1985).

Table 8-8. Federally and State-Listed Threatened or Endangered Aquatic Species Reported within a 16-Kilometer (10-Mile) Radius of the River Bend Site

Scientific Name	Common Name	Status[(a)]	Distance from the River Bend Site[(b)]	Source
		Fish		
Cyprinella camura	bluntface shiner	S2-S3	<3.2 km (2 mi)	LNHP 2004a
Etheostoma caeruleum	rainbow darter	S2-S3	beyond 3.2 km (2 mi) but within 16 km (10 mi)	LNHP 2004a
Scaphirhynchus albus	pallid sturgeon	FE; S1	<3.2 km (2 mi)	LNHP 2004a; FWS 2004a

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service under the Endangered Species Act, FE = Federal endangered (FWS 2004a). State status rankings developed by the Louisiana Natural Heritage Program: S1 - critically imperiled, S2 = imperiled, S3 = rare (LNHP 2004a). Hyphenated state status ranks indicate a range in the status of the species based on insufficient data to make a determination.
(b) Distances provided by LNHP (2004a).

The staff concludes that the overall impacts on Federally and State-listed threatened and endangered aquatic species from one or more new nuclear units and associated cooling towers at the River Bend site would be SMALL.

8.5.1.5 Socioeconomics

In evaluating the socioeconomic impacts of construction at the River Bend site, the staff and Entergy Nuclear undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources. The staff conducted some local interviews with knowledgeable local officials. No new data were collected.[a] The socioeconomic subsections follow the organizational structure of the socioeconomic discussions in Sections 2.8, 4.5, and 5.5. Impacts from both construction and station operation are discussed.

Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. However, extensive work is planned on the existing roads, and new routes are being built to reduce existing bottlenecks in the regional highway system, so no physical impact on the existing road network is expected. It is expected that all construction activities would occur within the existing River Bend site. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the new unit or units would be small incremental impacts associated with their normal operation.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. New units would produce noise from the operation of pumps, cooling tower fans, transformers, turbines, generators, and switchyard equipment, and traffic at the site would also be a source of noise. SERI states in its environmental report that any noise coming from the proposed Grand Gulf ESP site would be controlled in accordance with standard noise protection and abatement procedures (SERI 2005). By inference, this is also expected to apply to the River Bend site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to River Bend site (SERI 2005).

(a) Hurricanes Katrina and Rita in southern Louisiana displaced tens of thousands of people, which affected baseline socioeconomic conditions throughout the Gulf Coast states. Estimates in the DEIS have been affected, but no changes have been made to the text because of the uncertainty regarding to what extent the changes brought about by Katrina and Rita are permanent.

New units would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, new units would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce (SERI 2005).

Construction activities would be temporary and would occur mainly within the boundaries of the River Bend site. Offsite impacts would represent small incremental changes to offsite services supporting the construction activities. During station operations, noise levels would be managed to local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the physical impacts of construction and operation would be SMALL.

Demography

The population base is considered to be the population of significant population centers within a 80-km (50-mi) radius of the River Bend site. The combined population of West Feliciana Parish, East Feliciana Parish and the East Baton Rouge Parish, West Baton Rouge Parish, and Pointe Coupee Parish was 494,000 (USCB 2004) and, in 1997, was projected to grow by approximately 15 percent to about 570,000 by 2020 (LPDC 1997). The estimated population within an 80-km (50-mi) radius of the River Bend site is 907,000 (NRC 2004b). Most (approximately 70 percent) of the construction workforce are expected to come from within the region, and those who might relocate to the region would represent a small percentage of the larger population base (Entergy Nuclear 2001). While part of the station operation workforce is also expected to relocate into the region, their numbers are small (about 2000 total new employees and family members during construction, and a smaller, unspecified number during operations) when compared to the total base population, and their locations of residence would probably be scattered throughout the region. Based on the information in the environmental report (SERI 2005) and the Early Site Permit Selection Committee Notebook (Entergy Nuclear 2001) prepared by Entergy Nuclear and the NRC staff's independent review, the staff concludes that the demographic impacts from construction and operation within an 80-km (50-mi) radius of the River Bend site would be SMALL.

Social and Economic Impacts

Economy

The River Bend site is located in one of the stronger economic areas in Louisiana. The Baton Rouge area is the primary economic driving force in the area within an 80-km (50-mi) radius of the River Bend site. In recent years, the regional economy has become more diversified, with major chemicals, papermills, and refining businesses; financial and health care components; and a growing high-tech business sector. The local economic development leaders consider an additional unit or units at the River Bend site to be highly compatible with the current economy and their economic plans for the parish (Scott 2004a). Regionally, the service sector now offers the most employment opportunities. Construction and operation of one or more new nuclear units at the River Bend site would be expected to add to the economic prosperity of the region, especially in West Feliciana Parish.

Based on the information provided by SERI and its own independently obtained information, the staff reviewed the impacts of construction and operation on the economy of the region and concludes that the impacts would be minor everywhere in the region except West Feliciana Parish, where the impact could be beneficial and significant. Although the economic impacts would be diffused over several local jurisdictions, employment in West Feliciana Parish would increase by 50 percent during the peak of construction. Much of the economic impacts likely would be felt in the larger economic bases of East Baton Rouge Parish and the city of Baton Rouge.

Entergy Nuclear estimates that it would take 3150 construction workers 5 years to build one or more new nuclear units at the River Bend site (Entergy Nuclear 2001). Entergy Nuclear is expected to be able to attract the necessary workforce for construction activities at the River Bend site because of its proximity to the major population center of Baton Rouge. The availability of construction workers for regular construction projects of longer duration is reported to be good. The number of construction workers employed within the five parishes nearest the River Bend site was estimated to be approximately 27,000 in 2002 (Louisiana Department of Labor 2003).

The addition of new units would require an increase in the operations workforce of 1160 employees. Approximately 454 permanent employees currently work at the River Bend site (SERI 2004c). In its site comparison study, Entergy Nuclear (2001) stated that it expected 30 percent of the construction labor force for the new units would relocate from outside the region. Some nuclear defense sites are reducing their workforces as they change missions, and workers from these sites could be potential pools of labor for the operating workforce at River Bend.

Based on the information provided by Entergy Nuclear and the NRC staff's independent review, the staff concludes that construction labor would be readily available from within the region, and there would be little problem recruiting the required labor skills to enable the construction of new nuclear units at the River Bend site. Some of the operations workforce would already be in the region.

Taxes

Construction and operations workers would pay income, sales, and use taxes to Louisiana and to the local governments in the region where sales take place and property taxes to the counties in which they own a residence. Sales and use taxes would be paid from the sales of construction materials and supplies purchased for the project and on expenditures of both the construction and operations workforce for goods and services. SERI has made no estimate of the day-to-day expenditures that would occur in the region during construction. Corporate income taxes on profits would also be paid by those companies engaged in construction at the site.

There are two types of property taxes in Louisiana: tangible personal property taxes and real property taxes. Tangible personal property taxes would be paid by contractors during construction of the additional units. This tax is based on the value of property owned by the contractors that acquire taxable status in West Feliciana Parish during the construction period. Real property taxes are levied for the incremental increase in value to the entire site from the operation of the additional units. It is expected that West Feliciana Parish would be the only beneficiary of the these taxes. Property owned by Entergy currently accounts for 90 percent of the local tax base. The tax rate in West Feliciana Parish is the lowest in the state (70 mills); elsewhere in the state, tax rates generally range from 100 to 130 mills. In a few jurisdictions, tax rates as high as 200 mills are levied. For schools, the state reduces its funding allocation for education as the local jurisdictions provide more. In West Feliciana Parish, the state provides nothing, but the local district spends much more per student than the state average. Entergy Nuclear has a significant impact on the economic well being of West Feliciana Parish, with Entergy Nuclear paying over 80 percent of the property taxes between 1996 and 2000 (Housing Assistance Council 2002; Scott 2004a). The property tax base represented by a new nuclear facility on the Grand Gulf ESP site would represent nearly a doubling of the West Feliciana Parish tax base, but would have relatively little impact on adjacent parish finances.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the overall impacts from construction and operation on taxes collected through the income, sales and use, and property taxes would be barely noticeable, with the exception of West Feliciana Parish. The taxes paid, while substantial, are nevertheless a small sum when compared to the total amount of taxes collected by Louisiana and local governments in the region. Depending on the outcome of tax negotiations between Entergy and the state of Louisiana on the amount of property taxes, the staff considers that the overall impacts of the property taxes collected in West Feliciana Parish would be significant and beneficial relative to the total amount of taxes the county currently collects through property taxes.

Summary of Social and Economic Impacts

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the overall impacts of construction and operation of new unit(s) at the River Bend site would be LARGE beneficial to SMALL beneficial in the parishes near the site.

Infractructure and Community Services

Transportation

The general area around the River Bend site is served by several major highways, including Interstate 10, Interstate 12, U.S. Highways 61 and 190, and State Route (SR) 10. Baton Rouge is about a 20-minute drive from the River Bend site on four-lane roads. Site access from the west side of the Mississippi River is currently limited, but a new bridge is expected to replace existing ferry service at St. Francisville. The principal road access to the River Bend site is via the River Bend Access Road and via Louisiana SR 965, which is a two-lane paved road.

The construction of a new power facility would require additions to the workforce. In addition, construction materials, wastes, and excavated materials would be transported both to and from the site. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations. However, five of the seven reactor types referred to in the SERI environmental report are generally smaller and modular in nature. Consequently, transportation of plant equipment could be less challenging and workforce requirements are expected to be less than those for the conventional nuclear plants.

The level-of-service designation on River Bend Access Road and Louisiana SR 965 would likely be degraded during the peak construction period for a new nuclear plant at the River Bend site. Louisiana SR 965 intersects U.S. Highway 61 approximately 2.6 km (1.6 mi) from the plant and River Bend Access Road intersects U.S. Highway 61 approximately 2.2 km (1.4 mi) from the plant. Because it is the principal route from the direction of Baton Rouge, portions of U.S. Highway 61 would receive significantly more traffic during plant construction.

Direct rail access and a barge slip (which would have to be dredged) are available to the River Bend site, so large equipment would not have to be offloaded and transported by road. The

Baton Rouge Metropolitan Airport and New Orleans International Airport serve the area. The airports in Baton Rouge and New Orleans provide regular freight and passenger jet services and are of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

The impacts of station operation employees on the transportation system would be less than that incurred during construction of the ESP facilities. However, there would be increases in personal-use vehicles by commuting operations staff. Portions of U.S. Highway 61 may be affected by commuters to the plant site, particularly during shift changes. During new plant operation, the level-of-service designation on the access roads and U.S. Highway 61 may degrade to stable flow instead of the free flow indicated under a level-of-service “A” designation. This change in designation would indicate that the freedom to select speed is unaffected, but the freedom to maneuver is slightly diminished.

Based on a review of information provided by SERI, Entergy Nuclear, and the NRC staff’s reconnaissance-level review, the staff concludes that the impacts of a construction workforce and related transportation of construction supplies and materials on the transportation infrastructure at the River Bend site would be noticeable (and temporary). Some of the local roads could have their level of service degraded during construction to the point where operations of individual drivers could be significantly affected by interactions with the rest of the traffic. This would be at level-of-service “C” or lower. Also, it is possible that, given the heavy loads carried by vehicles transporting construction materials to the River Bend site, some of the roads may need improvement to carry the additional load.

Based on a review of information provided by SERI, Entergy Nuclear, and the NRC staff’s independent review, the staff concludes that the impacts of an operations workforce and related transportation impacts would be much less noticeable than during construction. There may be some minor congestion at shift changes and level of service may degrade.

<u>Recreation</u>

The River Bend site is an industrial site not used for recreation. Its current structures are not visually obtrusive from any vantage point because of the large size and wooded nature of the site. The existing units are well isolated from the river and from other vantage points. Any new units would not use a once-through cooling system, so cooling towers would be necessary. However, the River Bend site already has mechanical draft cooling towers, so additional cooling towers for the new reactors would not significantly change the existing appearance of the site that would affect any nearby recreation experience. Traditionally, visible plumes resulting from operation of cooling towers could cause a negative aesthetic effect. As long as any new transmission lines are confined to (possibly expanded) existing rights-of-way, as assumed in Section 8.5.1.3, the aesthetic effects of new transmission lines are not likely to be significant. Based on the information provided by SERI, Entergy, and the NRC staff’s independent review, the staff concludes that no noticeable impacts on recreation in the vicinity of the River Bend site would result from construction and operation of a new generating facility at the site.

Housing

A 18.7 percent vacancy rate out of a total of 4485 housing units currently exists in West Feliciana Parish (USCB 2005b). However, given the proximity of the River Bend site to the Baton Rouge metropolitan area, which has 12,000 vacant housing units in East Baton Rouge Parish alone, housing for construction workers, most of whom will be coming from within the region, and the subsequent operations workforce is expected to be available (USCB 2005b). Sufficient housing is available in West Feliciana Parish and the Baton Rouge area to support the additional workforce that would be needed to operate a new generating facility at the River Bend site (Scott 2004a).

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impact of a construction and operations workforce on the demand for housing could be easily handled. This conclusion is based on the availability of approximately 840 vacant housing units in West Feliciana Parish, existing construction plans, and the proximity of the River Bend site to the larger Baton Rouge metropolitan area.

Public Services

Water Supply and Waste Treatment. West Feliciana Parish would have to upgrade some of its water distribution lines from 15 to 20 cm (6 in. to 8 in.) to accommodate growth, but plans for that upgrade already are in place. The Parish has a plentiful groundwater supply and a complete Parish-wide water distribution system. The Parish government regulates sewage treatment, but there are individual sewage districts (Scott 2004a).

Most of the construction workforce would come from within the region, so their demands on the water treatment and distribution systems are already accounted for. The station operating workforce, some of which would probably relocate into the region, would probably reside throughout the region; therefore, their presence would not particularly affect any one community or jurisdiction. Based on the NRC staff's independent review, the staff concludes that the impact of construction and operation on the water treatment and distribution systems would not be noticeable.

Police, Fire, and Medical Facilities. In the larger metropolitan area of West Feliciana Parish, East Feliciana Parish, East Baton Rouge Parish, and Baton Rouge, and in nearby St. Francisville, police, fire, and medical facilities would not be materially affected by an increase in the construction workforce. It is anticipated that many of the workers who would be involved in construction at the River Bend site already live in the region and would commute to the site from their permanent residences. These workers already are being served by existing police, fire, and medical services and facilities.

Thirty percent of the resident construction workforce of 2835 (approximately 90 percent of the 3150 total workers) is anticipated to come from outside the region, resulting in an overall population increase of 2459 persons (Entergy Nuclear 2001). Because these workers would probably reside throughout the region, their presence would not particularly affect any one community or jurisdiction and is not expected to place inordinate demands on police, fire, and medical services and facilities. The impact of the operations workforce would likely be smaller, since the operations workforce is only 1160 (SERI 2005).

Based on the NRC staff's independent review, the staff concludes that the impact of construction and operations workforce on police, fire, and medical services facilities would not be noticeable. Most construction workers already live within the region. New operations workforce employees would live throughout the region, so there should be minimal new demands placed on these services and facilities by either construction or operations workers.

Social Services. A variety of emergency assistance, counseling, child and family services, and other social services are provided in each parish by the Louisiana Department of Social Services. During the construction phase at the River Bend site, there may be an increased demand for some social services.

Generally, construction and operation of a new generation facility at the River Bend site would be viewed as beneficial economically to the disadvantaged population segments served by the Louisiana Department of Social Services. The workforce associated with construction at the River Bend site would be relatively higher paid than other employment categories in the region. Construction and operation of new units should increase employment through the multiplier effect (see Section 4.5.3.1) and may enable the disadvantaged population to improve their social and economic position by moving up to higher paying jobs. At a minimum, the expenditures of the construction and operations workforce in the parishes for food, services, etc., could, through the multiplier effect, increase the number of jobs available to the disadvantaged population.

Based on the NRC staff's independent review, the staff concludes that the demand for social and related services as a result of construction and operation of a new generation facility at the River Bend site likely would be insignificant. Construction and operation would have a beneficial economic impact on the economically disadvantaged population of the region, which should decrease the demand for social services. There could be an initial increase in demand for social services at the beginning of the construction period, but this is considered manageable and limited.

Education

The West Feliciana Parish school system has just over 2000 students (NCES 2004b). There currently is no overcrowding in the system, and the system enjoys some of the lowest student teacher ratios in Louisiana, high standardized test performance, and excellent facilities (Scott 2004a). The extensive regional parochial school system is also considered to be strong. In the other parishes and cities of the region, it is anticipated that the construction and operations workforce would minimally affect school infrastructures because many construction workers already live within the region. Entergy Nuclear estimates that it would take 3150 construction workers 5 years to build one or more new nuclear units at the River Bend site (Entergy Nuclear 2001); most of the workforce would reside in the region already. Entergy Nuclear estimates that the population increase in the region during peak construction would be 2459, 759 of whom are likely to be children (Entergy Nuclear 2001). The operations workforce, while partly coming from outside and relocating into the region, would probably be distributed throughout the region, thereby placing little demand on school infrastructure.

It is anticipated that most of the construction workforce would come from within the area and would not relocate their families. Those construction and operations workers potentially relocating to the region would most likely reside throughout the region and, as a result, would not be in sufficient concentrated pockets to place an undue burden on the existing infrastructure. Based on the NRC staff's independent review, the staff concludes that the impact of the construction and operations workforce on education facilities in West Feliciana Parish and the area would be easily accommodated by the existing school systems and facilities.

Summary of Infrastructure and Community Services

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on infrastructure and community services from construction and operation of one or more new nuclear units at the River Bend site would be SMALL to MODERATE adverse.

Summary of Socioeconomics

In summary, on the basis of information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impacts of the construction and operations at the River Bend site on socioeconomics would be SMALL, with the exceptions that the transportation impacts during construction likely would be adverse and MODERATE and that the impacts on the West Feliciana Parish economy and tax base likely would be beneficial and LARGE. Some of the increase in taxes may have to be used to improve local transportation infrastructure.

8.5.1.6 Historic and Cultural Resources

The footprint for a new generating facility at the River Bend site does not appear to have any historic properties located within areas likely to be affected by new construction and operations (AEC 1974a). In 1972, Gulf States Utilities Company commissioned an archaeological survey of portions of the planned River Bend Station. No archaeological deposits were encountered during that survey (Neuman 1972). In 1978, Gulf States Utilities commissioned two transmission line surveys. Prehistoric sites were identified within the right-of-way, but not within the plant boundaries (Neuman 1978a, 1978b). In 1982, personnel from Gulf States Utilities informed the Louisiana State Archaeologist's Office of the remains of a 19th century sugar mill within the plant boundaries. Testing and evaluation of the mill remains conducted in 1983 determined that the site was not eligible for listing on the National Register of Historic Places (Shuman and Orser 1984). Miscellaneous archaeological surveys conducted over the years in the area indicate that while sites may exist on the premises, either the sites are not eligible for listing on the National Register of Historic Places or are located away from areas where new construction would likely occur. Protective measures would be implemented if historic and/or cultural resources were discovered during construction or during operations. In the event that an unanticipated discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would consult with him or her in assessing the discovery to determine if additional evaluation of the discovery is needed.

There are no significant differences between the Grand Gulf ESP site and the River Bend site that would make any material difference in the potential for historic properties or other important cultural sites to be adversely affected. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on historic and cultural resources at the River Bend site would be SMALL.

8.5.1.7 Environmental Justice

As part of the evaluation of the potential environmental justice impacts related to the River Bend site, the staff used information from interviews with community leaders, U.S. Census Bureau, Housing Assistance Council, and local Internet websites. Sightly over half of the population of West Feliciana Parish is African-American. About 20 percent of the population live below the Federal poverty level (Housing Assistance Council 2002). The pathways through which the environmental impacts associated with the construction of new units at the River Bend site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

Based on the information provided by Entergy Nuclear, SERI, and the NRC staff's independent review, the staff concludes that the offsite impacts of construction and operation of new units at the River Bend site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified.

8.5.2 Evaluation of the Pilgrim Nuclear Power Station Site

This section covers the staff's evaluation of the potential environmental impact of siting new nuclear units within the scope of the SERI PPE at the Pilgrim Nuclear Station (Pilgrim) site.

8.5.2.1 Land Use Including Site and Transmission Line Rights-of-Way

Site and Vicinity

The Pilgrim site is located on 647 ha (1600 ac) along the coast of Cape Cod, about 10 km (6 mi) east southeast of the central business district in the town of Plymouth, Massachusetts. The area around the site and the vicinity has become increasingly urbanized since the existing facility was built, but the area also features coastal forest, cranberry farms, and access to Cape Cod recreational areas. The new facility would be situated on a bluff above and to the west-northwest of the existing Pilgrim unit. Because the site of the ESP facility would use a portion of the existing Pilgrim site, no land would be preempted for additional facilities built at this site (SERI 2005).

The types of impacts of new facility construction and operations (i.e., physical, ecological, social, and radiological impacts) are likely to be similar to those expected for the Grand Gulf ESP site. The Pilgrim site is significantly different from Grand Gulf in that it is located within the costal zone of Cape Cod and is subject to the Coastal Zone Management Act of 1972 (CZMA), as amended. Congress enacted the CZMA to address the increasing pressures of over-development upon the nation's coastal resources. At the Federal level, the National Oceanic and Atmospheric Administration administers the Act. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by states is voluntary; however, the Commonwealth of Massachusetts has an approved coastal zone management program. The staff assumed that SERI would comply with all provisions of the CZMA as implemented in the Cape Cod region. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the land-use impacts on the site and vicinity of construction and operations would be SMALL.

Transmission Line Rights-of-Way

The existing 345-kV transmission line runs south-southeast from the Pilgrim site, crossing Commonwealth Highway 3, then turning west and continuing another 0.8 km (0.5 mi) to a substation near Long Pond Road, covering 7.6 km (4.75 mi). This transmission line right-of-way traverses rural coastal forested lands. The existing right-of-way crosses land currently zoned residential (0.4 to 0.8 ha (1 to 2 ac)) (40,000 to 80,000 sq ft lots). From the substation at 7.6 km (4.75 mi) from the Pilgrim switchyard, rights-of-way exit to the north and to the south and traverse lands zoned for conservation and passive recreation. Section 3.3 discusses the regulatory procedure required to link new large generation to the grid. The issues that could result in potential impacts of construction and operation in these transmission line rights-of-way (i.e., physical and ecological impacts) would be similar to those land-use impacts of construction and operation in the transmission line rights-of-way and offsite areas associated with the Grand Gulf ESP site. However, the existence of zoning regulations and the higher density of inhabitants in proximity to the affected rights-of-way distinguish the Pilgrim site from the Grand Gulf ESP site. Therefore, the staff concludes that the land-use impacts of transmission system construction associated with a new ESP facility could range from SMALL to MODERATE. For transmission system operations, impacts would be SMALL.

8.5.2.2 Water Use and Quality

Water Use

The Pilgrim site is located adjacent to Cape Cod Bay. Construction activities for new nuclear units at Pilgrim would have similar water use impacts (i.e., physical and ecological impacts) to Grand Gulf and would be bounded by the operational impacts. During operation, the consumptive use of water from the cooling towers would be very small compared to the supply available in the ocean; however, there are concerns with Pilgrim's existing level of entrainment, which could increase. Cooling towers in a salt water environment use fewer cycles of concentration than would be required with a similar cooling tower using fresh water. Therefore, the intake flow rate of makeup water and discharge flowrate of blowdown water are expected to be higher than at Grand Gulf. The staff concludes that the impacts on surface-water use and water supply at the Pilgrim site would be SMALL given the water supply available.

Water Quality

Construction activities for new nuclear units sited at Pilgrim would follow best management practices and have similar water-quality impacts as the construction at Grand Gulf, which would be bounded by the operational impacts. The additional heat from the relatively small amount of blowdown water would be commingled with the discharge of the existing Pilgrim Station. This addition would marginally increase the size of the current thermal plume. Thermal and chemical discharges to Cape Cod Bay would be regulated by the Massachusetts Department of

Environmental Protection and EPA via an NPDES permit issued to protect the environment. Since the combined discharge represents a very small fraction of the water volume, the staff concludes that the impacts on water quality at the Pilgrim site would be SMALL.

8.5.2.3 Terrestrial Resources Including Endangered Species

Construction Impacts

The western portion of the Pilgrim site is largely undeveloped, consisting primarily of forest that has been harvested multiple times and was burned in 1957. The most extensive plant community on the Pilgrim site and in the surrounding region is oak-pine forest, which covers most of the western portion of the site. Small tracts of permanently moist soil support plant species not associated with oak and pine forest, such as stands of red maple (*Acer rubrum*). Small tracts of other forest communities are also found onsite, such as black locust (*Robinia pseudoacacia*). Only very small ponds and artificially created wetlands occur on the Pilgrim site (south of the plant), in contrast to bogs and lakes that are a common feature of the surrounding landscape (AEC 1974b).

It is assumed that a new generating facility would be located on the western portion of the Pilgrim site and would thus primarily affect the oak and pine forest habitat, and that the small ponds and artificial wetlands would not be affected. Consequently, the impacts on habitat from construction of a new generating facility on the Pilgrim site are expected to be minor.

Potential construction impacts, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated using standard industrial procedures and best management practices. Standard practices, such as silt fences to control sedimentation and water sprays to limit dust generation, should be adequate to protect wetlands and other ecological resources on and in the vicinity of the site.

One transmission line right-of-way, extending a total length of 8 km (5 mi) (AEC 1974b) and covering 70 ha (173 ac) (NRC 1996), currently serves the Pilgrim site. It traverses rural coastal forest and does not cross any land known to be designated for special uses such as wildlife refuges or state natural areas. It is assumed this transmission line would not have the capacity to carry the power that would be generated by a new generating facility, and that a transmission system upgrade including new transmission lines and an additional right-of-way would be needed. It is assumed that any additional right-of-way would be an expansion, or doubling, of the existing right-of-way. Although land cover details are unknown for the transmission line right-of-way, the terrestrial ecological impacts associated with the expansion would be expected to be small, given the relatively short length of the right-of-way.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that impacts on terrestrial ecological resources from construction of a new generating facility at the Pilgrim site and construction associated with possible expansion of the existing Pilgrim transmission line right-of-way would be SMALL.

Threatened and Endangered Species

The Federally listed threatened or endangered terrestrial species that may occur in the vicinity of the Pilgrim site include one turtle, the Plymouth population of the redbelly turtle (*Chrysemys rubriventris bangsi*), and three birds: the roseate tern (*Sterna dougallii dougallii*), the Atlantic coast breeding population of the piping plover (*Charadrius melodus*), and the bald eagle (*Haliaeetus leucocephalus*) (Table 8-9) (FWS 2004b).

The redbelly turtle, a large, freshwater basking turtle of deep, coastal plain ponds, is restricted to approximately 17 ponds of varying sizes and one river site in Plymouth County, Massachusetts (FWS 1994; MNHESP 1995a). The current known range of the turtle overlaps the Pilgrim site (FWS 1994), and the species is known to occur within 3.2 km (2 mi) (Table 8-9) (MDFW 2004). Designated critical habitat for the species is located approximately 4.8 km (3 mi) to the southwest (FWS 1994). Therefore, the turtle could potentially occur on the Pilgrim site. Consequently, if construction of a new generating facility on the Pilgrim site were to affect the small ponds and wetlands and/or adjacent upland areas, which are typically important for egg laying and movement away from the ponds, it could potentially affect the species, if in fact the species is present.

Approximately 1.6 km (1 mi) of the Pilgrim transmission line right-of-way crosses critical habitat for the redbelly turtle (AEC 1974b; 45 FR 21828; FWS 1994). Within the critical habitat, the transmission line passes adjacent to a cranberry bog and otherwise crosses upland areas (FWS 1994). Expansion of the existing Pilgrim transmission line right-of-way could affect critical habitat via disturbance of vegetation and soils. Indirectly, this could adversely affect the species via destruction of basking, nesting, and overwintering areas around ponds and alteration of water quality resulting from erosion/siltation.

The Federally protected roseate tern is a colonial species that in Massachusetts prefers to nest along islands, coastal beaches, and inshore waters (MNHESP 1988a). The tern is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site (Table 8-9) (MDFW 2004) on Plymouth Bay (MNHESP 1988a). Because of this distance, it is not anticipated that construction of a new generating facility at the Pilgrim site would affect the tern. The Pilgrim transmission line right-of-way is located more than 3.2 km (2 mi) from this tern colony. Thus, it is not anticipated that expansion of the right-of-way would affect the tern. There is no proposed or designated critical habitat for the tern (52 FR 42064).

The Atlantic coastal breeding population of the piping plover in Massachusetts requires sandy coastal beaches for nesting that are relatively flat and free of vegetation (MNHESP 1990a). The plover is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) west of the Pilgrim

Table 8-9. Terrestrial Federally Listed and State-Listed Species Occurring in the Vicinity of the Pilgrim Site

Scientific Name	Common Name	Status[(a)]	Distance from the Pilgrim Site[(b)]	Source
Birds				
Ammodramus savannarum	grasshopper sparrow	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Charadrius melodus	piping plover (Atlantic coast population)	FT/ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004; FWS 2004b
Haliaeetus leucocephalus	bald eagle	FT/SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004; FWS 2004b
Pooecetes gramineus	vesper sparrow	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Sterna dougallii	roseate tern	FE/SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004; FWS 2004b
Reptiles				
Emydoidea blandingii	Blanding's turtle	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Pseudemys rubriventris bangsi	Plymouth redbelly turtle	FE/SE	<3.2 km (2 mi)	MDFW 2004; FWS 2004b
Moths and Butterflies				
Acronicta albarufa	barrens daggermoth	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Cicinnus melsheimeri	Melsheimer's sack bearer	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Erynnis persius persius	persius duskywing	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Hypomecis buchholzaria	Buchholz's gray	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Zanclognatha martha	pine barrens zanclognatha	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Damselflies				
Enallagma recurvatum	pine barrens bluet	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Plants				
Calamagrostis pickeringii	reed bentgrass	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004

Table 8-9. (contd)

Scientific Name	Common Name	Status[(a)]	Distance from the Pilgrim Site[(b)]	Source
Carex striata brevis	Walter's sedge	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Eupatorium leucolepis novae-angliae	New England boneset	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Isoetes acadiensis	acadian quillwort	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Lipocarpha micrantha	dwarf bulrush	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Ophioglossum pusillum	adder's-tongue fern	ST	<3.2 km (2 mi)	MDFW 2004
Rhynchospora inundata	inundated horn-sedge	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Rhynchospora nitens	short-beaked bald-sedge	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Rhynchospora torreyana	Torrey's beak-sedge	SE	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004
Sphenopholis pensylvanica	swamp oats	ST	beyond 3.2 km (2 mi) but within 16 km (10 mi)	MDFW 2004

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act, FE = Federal endangered, FT = Federal threatened (FWS 2004b). State status rankings developed by the Massachusetts Division of Fisheries and Wildlife (MDFW), SE = State endangered, ST = State threatened (MDFW 2004).
(b) Distances provided by MDFW (2004).

site (Table 8-9) (MDFW 2004) on Plymouth Bay (FWS 1996; MNHESP 1990a) where it likely nests within the roseate tern colony discussed above. Because of this distance, construction of a new generating facility at the Pilgrim site would not be expected to impact the plover. The Pilgrim transmission line is located more than 3.2 km (2 mi) from this plover colony. Thus, expansion of the existing Pilgrim transmission line right-of-way would also not be expected to impact the plover. There is no proposed or designated critical habitat for the Atlantic coastal breeding population of the piping plover (FWS 1996).

Bald eagles usually inhabit coastal areas, estuaries, and larger inland waters in Massachusetts (MNHESP 1995b). The bald eagle is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site (Table 8-9) (MDFW 2004). Year-round range occurs to the southwest of the Pilgrim site and an historical breeding site and winter range to the southeast (MNHESP 1995b). Because of this distance, construction of a new generating facility at the Pilgrim site would not be expected to impact the eagle. The Pilgrim transmission line is located more than 3.2 km (2 mi) from the eagle areas noted above. Thus, expansion of the existing Pilgrim transmission line right-of-way would not be expected to impact the eagle. There is no proposed or designated critical habitat for the bald eagle in the area of the Pilgrim site.

Two State-listed threatened birds are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: the grasshopper sparrow (*Ammodramus savannarum*) and the vesper sparrow (*Pooecetes gramineus*) (Table 8-9) (MDFW 2004). The grasshopper sparrow (MNHESP 1986a) and vesper sparrow (NJDFW 2004c) are species of open fields. The only habitat on the Pilgrim site similar to open fields is grass meadow. However, because this habitat type appears to comprise less than 3 percent of the site (AEC 1974b), it is unlikely that the grasshopper or vesper sparrow exist onsite. It is also unlikely that these species exist along the Pilgrim transmission line right-of-way because it crosses coastal forest habitat (AEC 1974b). Thus, it is not anticipated that construction of a new generating facility at the Pilgrim site or expansion of the Pilgrim transmission line right-of-way would affect these two sparrow species.

One State-listed threatened turtle is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: Blanding's turtle (*Emydoidea blandingii*) (Table 8-9) (MDFW 2004). Blanding's turtle is primarily aquatic, preferring densely vegetated shallow ponds, marshes, or small streams (MNHESP 1987). Because small ponds (but no marshes and small streams) are found on the Pilgrim site (AEC 1974b), Blanding's turtle could occur there and, thus, could be affected by construction of a new generating facility. The Pilgrim transmission line right-of-way crosses coastal forest habitat (AEC 1974b). However, it is unclear if the right-of-way also crosses ponds, marshes, or small streams that could support Blanding's turtle.

Five State-listed threatened or endangered moths and butterflies are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: barrens daggermoth (*Acronicta albarufa*), Melsheimer's sack bearer (*Cicinnus melsheimeri*), Persius duskywing (*Erynnis persius persius*), Buchholz's gray (*Hypomecis buchholzaria*), and pine barrens zanclognatha (*Zanclognatha martha*) (Table 8-9) (MDFW 2004). All five species occur in open pitch pine (*Pinus rigida*)/scrub oak (*Quercus ilicifolia*) barrens (Wagner et al. 2003). Barrens daggermoth and Melsheimer's sack bearer also occur in scrub oak thickets (Wagner et al. 2003). Persius duskywing, Buchholz's gray, and pine barrens zanclognatha likely do not occur on the Pilgrim site, because pitch pine/scrub oak barrens are not known to occur there (AEC 1974b). However, barrens daggermoth and Melsheimer's sack bearer could potentially occur on the Pilgrim site, because oak forest and mixed saplings and pole-sized oak stands occur there (AEC 1974b). Thus, these two species could be directly affected by construction of a new generating facility on the Pilgrim site if present in the impact area or indirectly via destruction of host plants. Insufficient detail is available about plant communities to determine whether these five moths and butterflies could occur along the coastal forest-dominated Pilgrim transmission line right-of-way (AEC 1974b).

One State-threatened damselfly is known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Pilgrim site: pine barrens bluet (*Enallagma recurvatum*) (Table 8-9) (MDFW 2004). Pine barrens bluet appears to be restricted to ponds on the coastal plains (MNHESP 2003). Because small ponds are found on the Pilgrim site (AEC 1974b), pine barrens bluet could occur there and, thus, could be affected by construction of a new generating facility. The Pilgrim transmission line right-of-way crosses coastal forest habitat (AEC 1974b). However, it is unclear if it also crosses ponds on the coastal plains, marshes, or small streams that could support pine barrens bluet.

Only one State-listed threatened or endangered terrestrial plant species is known to occur within 3.2 km (2 mi) of the Pilgrim site: adder's tongue fern (*Ophioglossum pusillum*) (Table 8-9) (MDFW 2004). Adder's tongue fern in Massachusetts is found in ecologically diverse sites (boggy meadows, acidic fens [sphagnous areas with seeping groundwater], borders of marshes, wet fields, and moist woodland clearings) (MNHESP 1990b). Because small ponds and developed wetlands occur on the Pilgrim site, adder's tongue fern could occur there and, thus, could be affected by construction of a new generating facility. However, it is unclear whether the transmission line right-of-way also crosses wet habitats that could support adder's tongue fern.

Nine other State-listed threatened or endangered terrestrial plant species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the site: reed bentgrass (*Calamagrostis pickeringii*), Walter's sedge (*Carex striata brevis*), New England boneset (*Eupatorium leucolepis novae-angliae*), acadian quillwort (*Isoetes acadiensis*), dwarf bulrush (*Lipocarpha micrantha*), inundated horn-sedge (*Rhynchospora inundata*), short-beaked bald-sedge (*Rhynchospora nitens*), Torrey's beak-sedge (*Rhynchospora torreyana*), and swamp oats (*Sphenopholis pensylvanica*) (Table 8-9) (MDWF 2004). Seven of these species – Walter's sedge, New England boneset, acadian quillwort, dwarf bulrush, inundated horn-sedge, short-beaked bald-sedge, and Torrey's beak-sedge – occur along the shorelines of or within freshwater ponds (MDCNAP 2004a, 2004b; MNHESP 1986b, 1988b, 1988c, 1990c, 1993). Reed bentgrass occurs along the shorelines of coastal, nontidal, nonforested wetlands (MDCNAP 2004c). Swamp oats occur in a variety of wet places, including swamps (ODNR 2004). Because small ponds and developed wetlands occur on the Pilgrim site, these nine species could occur onsite and, thus, could be affected by construction of a new generating facility. The Pilgrim transmission line right-of-way crosses coastal forest habitat (AEC 1974b). However, it is unclear whether it also crosses wet habitats that could support these species.

Based on potential impacts on the Federally listed redbelly turtle and potential impacts on many of the State-listed species, the staff concludes the impacts on threatened and endangered species from construction of a new generating facility on the Pilgrim site and possible expansion of the existing transmission line right-of-way would be MODERATE to LARGE.

Operational Impacts

Impacts on terrestrial resources that may result from operation of one or more new nuclear units at the Pilgrim site include those associated with cooling towers and transmission lines. The Pilgrim plant currently employs a once-through cooling system, but cooling towers would be employed for a new nuclear unit(s). Uncertainty exists regarding the potential impacts of salt drift deposition on crops and ornamental vegetation and native plants from cooling towers that draw salt water with a salinity of over 30 ppt. The impacts of salt drift from cooling towers using fresh water were evaluated in the GEIS (NRC 1996) and were found to be of small significance for all plants. The EPA also concluded that impacts on crops and ornamental vegetation from salt drift from plants using estuarine/tidal makeup water would be minimal (EPA 2001). However, because of the uncertainty surrounding cooling towers that use salt water, it should be conservatively concluded that there could be damage to offsite vegetation resulting from salt drift from operation of cooling towers for the new nuclear unit(s) at the Pilgrim site.

The impacts associated with bird collisions with cooling towers for existing power plants were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with multiple cooling towers of various types. The staff is not aware of any new information that would cause it to modify its earlier conclusion. On these bases, for the purposes of consideration of alternative sites, the impacts of bird collisions with cooling towers resulting from operation of one or more new nuclear units at the Pilgrim site would be negligible.

For both natural and mechanical draft cooling towers, the noise level from cooling tower operation is anticipated to be 55 dBA at 300 m (1000 ft) (SERI 2005). The noise level for dry cooling towers is somewhat higher. However, these noise levels are all well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the Pilgrim site would not be likely to disturb wildlife beyond 300 m (1000 ft) from the source. Further, impacts within this distance, if any, would be considered negligible owing to the large expanses of open habitat into which mobile wildlife species could move if disturbed. Consequently, the impacts of cooling tower noise on wildlife from operation of one or more new nuclear units at the Pilgrim site would be minimal.

The impacts usually associated with transmission line operation consist of bird collisions with transmission lines. The staff assumes that the addition of new lines for expansion of the transmission system for one or more new nuclear units at the Pilgrim site would present few new opportunities for bird collisions, and that no measurable reduction in local bird populations would result. The issue of bird collisions with transmission lines was evaluated previously in the GEIS (NRC 1996) and was found to be small for all facilities, including those with multiple transmission line rights-of-way with various numbers of transmission lines. Based on the above rationale and the associated conclusions presented in GEIS (NRC 1996), the effects of bird collisions with transmission lines for one or more new nuclear units at the Pilgrim site would be negligible.

The impacts usually associated with transmission line right-of-way maintenance (cutting and herbicide application) consist of erosion/siltation and disturbance of wildlife and wildlife habitat and similar impacts where rights-of-way cross floodplains and wetlands. The staff assumes that right-of-way maintenance would be conducted similar to current operations, only over a wider area. The effects of right-of-way maintenance were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with transmission line rights-of-way of various widths. The staff is not aware of any new information that would cause it to modify its earlier conclusion. Therefore, general wildlife and wildlife habitat would be expected to be minimally affected by right-of-way maintenance in the expanded transmission line right-of-way. However, it is unknown to what extent the redbelly turtle would be affected by increasing the area of right-of-way maintenance over the approximately 1.6-km (1-mi) segment of Pilgrim transmission line right-of-way that crosses critical habitat for the species. Nonetheless, it is likely that potential impacts on the redbelly turtle (e.g., mortality, destruction of basking, nesting, and overwintering areas around ponds) and its critical habitat (e.g., alteration of water quality resulting from erosion/siltation) from right-of-way maintenance would be less acute, although more long-term, than the construction impacts resulting from right-of-way widening. Therefore, potential impacts on the species from right-of-way maintenance in the expanded right-of-way could be minor to modest.

The staff reviewed the operation of one or more nuclear units at the Pilgrim site, including the associated heat-dissipation system and transmission line operation and right-of-way maintenance. Because of the potential for salt damage to vegetation from cooling tower drift and potential impacts on the Federally endangered redbelly turtle from transmission line right-of-way maintenance, the staff concludes that the impacts of operation of one or more nuclear units at the Pilgrim site on terrestrial resources and threatened and endangered species could range from SMALL to MODERATE.

8.5.2.4 Aquatic Resources Including Endangered Species

Construction and Operation Impacts

The staff does not expect that the aquatic resources near the Pilgrim site would be affected by the construction and operation of new nuclear unit(s) and associated cooling towers. The existing intake structure in Cape Cod Bay would be sufficient to withdraw water necessary for one or more ESP units using closed-cycle cooling. Discharges to Cape Cod Bay would not increase substantially over the discharges from the existing unit. Thus, issues with impingement, entrainment, and heat shock from the current system are not expected to increase substantially for the operation of new nuclear unit or units. Current dredging activities for operation of the existing intake system would have to continue.

Since 1974, the licensee has identified approximately 68 species through programs on impingement and entrainment. Of these species, approximately 26 are of commercial or recreational value (EPA 2002). Winter flounder (*Pleuronectes americanus*) is one of the species that is important to the commercial and recreational industry in the vicinity of the Pilgrim Nuclear Station. In response to concerns from entrainment of winter flounder larvae, Entergy Nuclear and the Massachusetts Division of Marine Fisheries have been raising flounder in a hatchery and releasing them into Cape Cod Bay (Galya et al. 2003; Lawton 2000; NEI 2002). Operation of new nuclear unit(s) at the Pilgrim site would result in increased use of cooling water from Cape Cod Bay by approximately 20 percent over current Pilgrim Nuclear Station rates. This would increase entrainment of winter flounder larvae approximately proportional to the amount of water withdrawal. Increased production of hatchery flounder could be used to mitigate the anticipated increased in larval mortality resulting from the operation of new unit(s).

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impacts on aquatic ecological resources from construction of new nuclear unit(s) and associated cooling towers at the Pilgrim ESP site would be SMALL. However, the overall impacts on aquatic ecological resources from operation of new nuclear unit(s) and associated cooling towers at the Pilgrim ESP site, considering the potential for increased entrainment of winter flounder larval would be SMALL to MODERATE.

Threatened and Endangered Species

Federally listed threatened and endangered species are found within the vicinity of Cape Cod Bay (Table 8-10); however, construction and operation of new nuclear unit(s) are not expected to affect the species. National Oceanic and Atmospheric Administration (NOAA) Fisheries identified three species of sea turtles and two species of whales that are known to be seasonally located in waters off Massachusetts and may be present in the vicinity of the site (NMFS 2004). The sea turtles include loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), and leatherback turtle (*Dermochelys coriacea*). The whales include North Atlantic right whale (*Eubalaena glacialis*) and humpback whale (*Megaptera novaeangliae*). No federally threatened or endangered species were identified at the Pilgrim site by the U.S. Fish and Wildlife Service (FWS 2004b).

One State-listed threatened species has been identified within the vicinity of the Pilgrim site (Table 8-10). The American brook lamprey (*Lampetra appendix*) are primitive jawless, eel-like fish and are a non-parasitic species of lamprey. They may grow as large as 0.2 m (8 in.). Their larvae live for 4 to 6 years in fine sediment of backwaters or freshwater streams. When they metamorphose into an adult, they stop feeding, spawn and die. While the American brook

Table 8-10. Aquatic Federally and State-Listed Species Occurring in the Vicinity of the Pilgrim Site

Scientific Name	Common Name	Status[(a)]	Distance from the Pilgrim Site[(b)]	Source[(b)]
Fish				
Lampetra appendix	American brook lamprey	ST	<3.2 km (2 mi)	MDFW 2004
Mammals				
Eubalaena glacialis	North Atlantic right whale	FE	16 km (10 mi)	NMFS 2004
Megaptera novaeangliae	humpback whale	FE	16 km (10 mi)	NMFS 2004
Reptiles				
Caretta caretta	loggerhead turtle	FT	16 km (10 mi)	NMFS 2004
Dermochelys coriacea	leatherback turtle	FE	16 km (10 mi)	NMFS 2004
Lepidochelys kempii	Kemp's ridley turtle	FE	16 km (10 mi)	NMFS 2004

(a) Federal status rankings developed by the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act, FE = Federal endangered, FT = Federal threatened. State status rankings developed by the Massachusetts Division of Fisheries and Wildlife (MDFW), ST = State threatened (MDFW 2004).
(b) Distances provided by MDFW (2004) and U.S. National Marine Fisheries Service (NMSF 2004).

lamprey is found in the vicinity of the Pilgrim site, it is not found on the site. Operations and future construction are not likely to affect the streams within 16 km (10 mi) where the lamprey may be found.

The staff is unaware of any incidents involving threatened and endangered species and the operation of Pilgrim Nuclear Station. No sea turtles or whales have been impinged or entrained at the Pilgrim Nuclear Station, nor have any of these species been observed in the vicinity of the station since biological monitoring began in 1973 (Entergy Services 2005). The additional intake flow as a result of new nuclear unit(s) at the Pilgrim site is unlikely to increase the probability of impingement of sea turtles and whales. Based on information provided by SERI and the NRC staff's independent review, the staff concludes that the overall impacts on threatened and endangered aquatic species from construction and operation of new nuclear unit(s) and associated cooling towers at the Pilgrim site would be SMALL.

8.5.2.5 Socioeconomics

In evaluating the socioeconomic impacts of construction at the Pilgrim site, Entergy Nuclear undertook a "reconnaissance" survey of the site using readily obtainable data from the Internet or published sources. The staff conducted local interviews with knowledgeable local officials. No new data were collected. The socioeconomic subsections follow the organizational structure of the socioeconomic discussions in Sections 2.8, 4.5, and 5.5. The impacts expected from both construction and station operation are discussed.

Physical Impacts

Construction activities can cause temporary and localized physical impact such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Some of these roadways, such as the Pilgrim access road and Massachusetts Route 3A with which it connects, could require some minor repairs or upgrading (such as patching and filling potholes) to allow safe transport of these materials and equipment. However, no extensive work is planned for the existing roads. It is expected that all construction activities would occur within the existing Pilgrim site. Offsite areas that would support construction activities (for example borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impact on those facilities from construction of the new unit(s) would be small and incremental and associated with their normal operation.

Potential impacts from station operation would include noise, odors, exhausts, thermal emissions, and visual intrusions. There would be a significant visual intrusion because the existing site does not have cooling towers and cooling towers would be proposed for any new units. The new unit(s) would produce noise from the operation of pumps, cooling tower fans, transformers, turbines, generators, and switchyard equipment, and traffic associated with construction and operation of the new unit(s) would also produce noise. SERI states that any noise coming from the proposed Grand Gulf ESP site would be controlled in accordance with standard noise protection and abatement procedures (SERI 2005). By inference, this is also expected to apply to the Pilgrim site. Regulations concerning noise limits can be found in 310 CMR 7.10: Noise, the Commonwealth of Massachusetts Air Pollution Control Regulations. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to and from the Pilgrim site (SERI 2005).

The new unit(s) would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited short-term basis. During normal plant operation, the new unit(s) would not use a significant quantity of chemicals that could generate odors exceeding odor threshold values. Appropriate speed limits would minimize the dust generated by the commuting workforce (SERI 2005).

Construction activities would be temporary and would occur mainly within the boundaries of the Pilgrim site. Offsite impacts would represent small incremental changes to offsite services supporting the construction activities. During station operations, noise levels would be managed by complying with local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should help minimize production of odors. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the physical impacts of construction and operation would be SMALL to MODERATE.

Demography

The population base is considered to be the population of significant population centers within a 80-km (50-mi) radius of the Pilgrim site. The combined population of the Boston Metropolitan Statistical Area is over six million people (USCB 2004). The 2000 U.S. Census reported the population within the five counties nearest the Pilgrim site (Plymouth, Barnstable, Suffolk, Norfolk, and Middlesex Counties) to be about 3.5 million, and the Massachusetts Institute for Social and Economic Research middle population projection series projected the counties to grow by approximately 6 percent to 3.7 million by 2020 (MISER 2004).

Entergy Nuclear (Entergy Nuclear 2001) assumed that 75 percent of the resident construction workforce of 2835 is expected to already live in the region, and the projected 2000 people who might relocate to the region would represent a small percentage of the larger population base. While an unknown percentage of the station operation workforce would be expected to relocate into the region, the increase is a small percentage of the total base population, and they would probably reside throughout the region. Based on the information in the SERI environmental report (SERI 2005), the Early Site Permit Selection Committee Notebook (Entergy Nuclear 2001), and the NRC staff's independent review, the staff concludes that the demographic impacts within an 80-km (50-mi) radius of the region resulting from construction and operation would be SMALL.

Social and Economic Impacts

<u>Economy</u>

The Pilgrim site is located in the town of Plymouth in Plymouth County, which is much smaller than the Boston metropolitan area, approximately 64 km (40 mi) to the north. This part of Massachusetts is growing quickly, in part because of the suburbanization of Boston and the fact that the Cape Cod Commission acts as a strong constraint on growth on nearby Cape Cod. Tourism is a primary economic driving force in the Plymouth County area, with about 10,000 to 15,000 people living in summer rental housing. About 3500 people are employed in the tourism industry out of 13,300 employed in the county. Other effects of tourism include $80 million in payroll, State tax payment of about $17 million, and local tax payments of about $15 million (TIA 2003). In recent years, the regional economy has become more diversified and includes major businesses, financial and health care components, and a growing "high-tech" sector. Local industrial parks are reportedly fully occupied (Scott 2004b). The local economic development leaders consider construction and operation of additional unit(s) at the Pilgrim site to be incompatible with the current tourism-based economy and their economic plans for the county (Scott 2004b). Regionally, the service sector now offers the most employment opportunities. Construction and operation of new reactors at the Pilgrim site would decrease the availability of housing in Plymouth County, where new housing and growth control are already issues.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff reviewed the impact of station construction and operation on the regional economy and concludes that the impact would not be noticeable in most of the region except for Plymouth County, where the impact could be either beneficial or adverse and significant, depending on how other economic sectors (most noticeably tourism) are affected. The magnitude of the economic impact would be diffused in the larger economy in the Boston metropolitan area. With the smaller economic bases of Plymouth County, the economic impact would be more noticeable.

Entergy Nuclear estimates that it would take 3150 construction workers 5 years to build one or more new nuclear units at the Pilgrim site (Entergy Nuclear 2001). SERI is expected to be able to attract the necessary workforce for construction activities at the Pilgrim site because of its proximity to the major population center of Boston. In 2003, the construction industry employed over 10,500 workers in Plymouth County and over 85,000 in the Boston Labor Market Area (Massachusetts Division of Career Centers and Division of Unemployment Insurance 2004).

The addition of the proposed new unit(s) would require an increase in the operations workforce of 1160 employees. A total of 569 permanent employees currently work at the Pilgrim site (SERI 2004c), plus numerous additional contractor employees during outages. In its site comparison study, Entergy Nuclear stated that it expected 25 percent of the construction labor force for the new unit(s) would relocate from outside the region (Entergy Nuclear 2001). Some nuclear defense sites are reducing their workforces as they change missions, and workers from these sites could be potential pools of labor for the operating workforce at Pilgrim.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that there would be little impact on the availability of construction and operating workers. Construction labor would be available from within the region, and there would be little problem recruiting the required labor skills to enable the construction of the nuclear unit(s) at the Pilgrim site. Much of the operations workforce likely would relocate to the region.

Taxes

Construction and operations workers would pay income, sales, and use taxes to Massachusetts and the local governments in the region where sales take place and property taxes to the counties in which they own a residence. Sales and use taxes would be paid from the sales of construction materials and supplies purchased for the project and on expenditures of both the construction and operations workforce for goods and services. SERI has made no estimate of the day-to-day expenditures that would occur in the region during construction. Corporate income taxes on profits would also be paid by those companies engaged in construction.

There are two types of property taxes in Massachusetts. The first is the tangible personal property taxes paid by contractors during construction of the additional unit(s). This tax is based on the value of property owned by the contractors that acquire taxable status in the town of Plymouth during the construction period. The second is the real property taxes levied for the incremental increase in value to the entire site from the operation of the additional unit(s). It is expected that the town of Plymouth would be the only beneficiary of the these taxes. Entergy Nuclear Generation Company currently has a significant but declining impact on the economic well-being of Plymouth County. Entergy Nuclear Generation Company is reportedly the second largest taxpayer in Plymouth with the existing Pilgrim plant having a negotiated value of $125 million under a payment-in-lieu-of-taxes agreement that declines after 2008 (SERI 2004c). The current value of property owned by Entergy Nuclear Generation Company is about one third the assessed value for the industrial property and 1.7 percent of the $7.3 billion local assessed value in the municipality of Plymouth (Commonwealth of Massachusetts Department of Revenue 2004). While the value of new unit(s) would be subject to negotiations of a payment-in-lieu-of-taxes agreement, the assessed value of a new plant would be in the vicinity of $1 billion, thus increasing the municipal total assessed values by about 14 percent. At the 2004 commercial rate of 11.81 mills (Town of Plymouth 2005), the estimated tax bill for the property would be $11.8 million per year. Local officials believe that the value of other property, especially that related to tourism, might decline in value if a new plant were built (Scott 2004b), thereby offsetting at least some of this increase. The level of taxes paid would depend on the outcome of tax negotiations between Entergy and the local officials on the amount of property taxes, but could noticeably increase the property taxes collected in Plymouth County.

Summary of Social and Economic Impacts

Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on social and economic resources from construction and operation of new nuclear unit(s) at the Pilgrim site would be MODERATE adverse resulting from the physical and social demands, for example, to MODERATE beneficial resulting from economy and tax base, for example.

Infrastructure and Community Services

Transportation

The general area around the Pilgrim site is served by several major highways, but site access from the south side of Plymouth is crowded (Scott 2004b). The principal road access to the Pilgrim site is via Power House Road from Massachusetts Highway 3A, both of which are winding, low-speed, two-lane paved roads that pass through wooded areas.

The construction of new power unit(s) would require significant additions to the workforce. In addition, construction materials, wastes, and excavated materials would be transported both to and from the site. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations. In addition, the level of service would significantly degrade. There are no current plans to upgrade either road. No direct rail access is available to the Pilgrim site, so large equipment would have to be offloaded and transported by road and/or barge. Pilgrim has an onsite barge slip that can be used for the transport of large loads, thereby reducing some of the burden on road access.

The Providence Regional Airport in Providence, Rhode Island, and Logan International Airport in Boston serve the area. These airports provide regular freight and passenger jet services and are of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

The impact of station operation employees on the transportation system would be less than that incurred during construction of the ESP facilities. However, there would be increases in personal-use vehicles by commuting operations staff. Portions of Massachusetts Highway 3A may be affected by commuters to the plant site, particularly during shift changes. During new plant operation, the level of service on Massachusetts Highway 3A and Power House Road would degrade, but not as significantly as during construction.

Based on a review of information provided by SERI, Entergy Nuclear, and the NRC staff's reconnaissance-level review, the staff concludes that the impacts of a construction workforce and related transportation of construction supplies and materials on transportation infrastructure would significantly degrade their level of service during construction. Also, it is possible that, given the heavy loads carried by vehicles transporting construction materials to the Pilgrim site, some of the roads may need repair to carry the additional load.

Recreation

The Pilgrim site is clearly an industrial site. However, while its current structures are not visually obtrusive from any vantage point, the Pilgrim site is quite visible to recreational boaters and from the residential neighborhoods on highlands along the shoreline to the south of the existing facilities. Any new facilities would not be able to take advantage of once-through cooling, so cooling towers would be necessary and would be visually obvious. Traditionally, visible plumes generated by the operation of cooling towers could cause a negative aesthetic effect. As long as any new transmission lines are confined to (possibly expanded) existing rights-of-way, as assumed in Section 8.5.2.3, the aesthetic effects of new transmission lines are not likely to be significant.

Housing

The 2000 U.S. Census reported that over 13,100 housing units out of about 181,500 in existence in Plymouth County in April 2000 were vacant; this amounts to a 7.3 percent vacancy rate (USCB 2004). However, over 8900 units, or 4.7 percent of the total number of units, were considered seasonal or vacation property (mostly summer residences, and most of which likely would be vacant in early April), meaning that the “true” number of vacant houses was considerably lower in Plymouth County. Low vacancy rates are currently a challenge during plant outages at the existing Pilgrim plant (Scott 2004b). Given the proximity of the Pilgrim site to the Boston metropolitan area, housing for construction workers, most of whom will be coming from within the region, and the operations workforce is expected to be available, although not in Plymouth itself. The ability of the Plymouth area to supply additional housing for construction workers is limited (Scott 2004b).

Public Services

Water Supply and Waste Treatment. Plymouth County has a municipal water supply system that serves the town of Plymouth and a 269-km^2 (104-mi^2) area. Permitted groundwater wells supply this system. Water supply needs in the intermediate term can be met, but there is little excess capacity (Scott 2004b).

Most of the construction workforce would come from within the region, so they already are accounted for in the demand placed on the regional water systems. The station operating workforce, while relocating to the region, would probably reside throughout the area, so they would not affect any one community or jurisdiction. Based on the NRC staff’s independent review, the staff concludes that the impact of construction and operation on water supply treatment facilities would not be noticeable.

Police, Fire, and Medical Facilities. In the larger metropolitan area of Boston and in Plymouth itself, police, fire, and medical facilities would not be materially affected by an increase in the construction workforce. It is anticipated that many of the construction workers will already live in the region and would commute to the Pilgrim site. As a result, these workers already are being served by existing services and facilities.

It is anticipated that an unknown percentage of the operations workforce and their families will come from outside the region. Most likely they would reside throughout the region (although possibly not in Plymouth because of its limited availability of housing) and would not concentrate in any one place or jurisdiction. Should this occur, there should not be inordinate demands placed on police, fire, and medical services and facilities.

Based on the NRC staff's independent review, the staff concludes that the impacts of construction and operations workforce on police, fire, and medical services and facilities would be easily handled by existing capabilities. Most construction workers already live within the region. New operations workforce employees would reside throughout the region. As a result, there should be minimal new demands placed on these services and facilities by either construction or operations workers.

Social Services. Social services in the Commonwealth of Massachusetts are provided in each county by the Massachusetts Department of Social Services, and a variety of other public and private social service agencies. During the construction phase at the Pilgrim site, there may be an increased demand for social services.

Generally, construction and operation of new nuclear unit(s) at the Pilgrim site would be viewed as beneficial economically to the disadvantaged population segments served by Massachusetts Department of Social Services. The construction workforce associated with the Pilgrim site would be relatively higher paid than other employment categories in the region. Construction and operation of new unit(s) should increase employment through the multiplier effect (see Section 4.5.3.1), projected by Entergy Nuclear at 1260 jobs during the construction period (Entergy Nuclear 2001), and may enable the disadvantaged population to improve their social and economic position by advancing to higher paying jobs. At a minimum, the expenditures of the construction and operations workforce in the counties for food, services, etc., could, through the multiplier effect, increase the number of jobs that could be filled by members of the disadvantaged population. This would have a beneficial economic impact on the economically disadvantaged population of the region, which should decrease the demand for social services. There could be an initial increase in demand for social services at the beginning of the construction period, but this is considered manageable and limited in extent.

Education

The Plymouth school system has just over 8750 students (Massachusetts Department of Education 2004a). There currently is significant overcrowding in the system (Scott 2004b), and the system is ranked slightly below the median (i.e., 188 out of 320) of Massachusetts school districts in spending (Massachusetts Department of Education 2004b). In the other counties and cities of the region, it is anticipated that the construction and operations workforce would affect school infrastructure minimally. The reasons are that many construction workers already live within the region. Entergy Nuclear estimates that the number of persons added to the region during construction would be 2000, 610 of whom are likely to be children (Entergy Nuclear 2001), and most of whom would not be attending Plymouth schools. The operations workforce, while coming from outside and relocating into the region, would probably reside throughout the region, thus placing little demand on school infrastructure as a result.

Summary of Infrastructure and Community Services

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on infrastructure and community services from construction and operation of new nuclear unit(s) at the Pilgrim site would be MODERATE.

Summary of Socioeconomics

In summary, based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the socioeconomic impacts of construction and operation of new reactors on the region surrounding the Pilgrim site would be SMALL, except in Plymouth County. In Plymouth County, the exceptions are as follows: the impacts on the tax base of the town of Plymouth during operations would be beneficial and MODERATE; the impacts on the economy of Plymouth County may be either beneficial or adverse, depending on how other sectors of the economy react, and up to MODERATE in extent; local transportation and housing availability are likely to be adversely affected and the effect is likely to be MODERATE.

8.5.2.6 Historic and Cultural Resources

The area at the Pilgrim site where new reactors would be built and operated does not appear to be the location of any historic properties (AEC 1974b). Previous archaeological surveys indicate that while sites may exist on the premises, either the sites are not eligible for listing on the National Register of Historic Places or they are located away from likely areas of new construction. Protective measures would be put in place in the event that historic or archaeological materials are discovered during construction or during operations. In the event that an unanticipated discovery is made, site personnel would be instructed to notify the State Historic Preservation Officer and would conduct an assessment of the discovery to determine if additional work is needed.

No significant differences exist between the Grand Gulf ESP site and the Pilgrim site that would make any material difference in the potential for historic properties or other important cultural sites to be adversely affected. Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impacts on historic and cultural resources at the Pilgrim site would be SMALL.

8.5.2.7 Environmental Justice

As part of the evaluation of the potential environmental justice impacts related to the Pilgrim site, the staff used information from the U.S. Census Bureau and local interviews. There is a very limited minority population in Plymouth County. This population is concentrated in the vicinity of Brockton (NRC 2004b) and makes up only about 12 percent of the total population (USCB 2004). The pathways through which the environmental impacts associated with the construction of one or more additional new nuclear units at the Pilgrim site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

Based on the information provided by Entergy Nuclear, SERI, and the NRC staff's independent review, the staff concludes that the offsite impact of construction and operation of new unit(s) at the Pilgrim site to minority and low-income populations would be not be evident. At the 2000 U.S. Census, Plymouth County had a lower percentage of low-income persons (6.6 percent) than did Massachusetts (9.9 percent), which in turn had a lower percentage than the nation (12.4 percent). However, there are a few low income block groups concentrated in Brockton and also one centered on the East Wareham-Onset area (USCB 2005a). No adverse and disproportionately high impacts were identified. Impacts in the region would be SMALL.

8.5.3 Evaluation of the FitzPatrick Nuclear Power Plant Site

This section covers the staff's evaluation of the potential environmental impacts of siting one or more new nuclear units within the scope of the SERI PPE at the James A. FitzPatrick Nuclear Plant site (FitzPatrick).

8.5.3.1 Land Use Including Site and Transmission Line Rights-of-Way

Site and Vicinity

The FitzPatrick site is located on 360 ha (900 ac) along the shore of Lake Ontario, about 11 km (7 mi) east-northeast of Oswego, New York. The area around the site and the vicinity is known as Nine Mile Point and is shared with the Nine Mile Point Nuclear Station. In the past, the land in the vicinity of the existing FitzPatrick plant was farmed, but it has been fallow since initial construction of the plant and is now second-growth forest and brush. The new ESP facility would be situated next to or just east of the existing plant. Because the site of the ESP facility would use a portion of the existing FitzPatrick site, no land would be preempted for additional facilities (SERI 2005).

The types of impacts of new facility construction and operations (i.e., physical, ecological, social, and radiological impacts) are likely to be similar to those expected for the Grand Gulf ESP site. The FitzPatrick site is different from Grand Gulf in that it is located within the costal zone of Lake Ontario and is subject to the Coastal Zone Management Act of 1972. Congress enacted the CZMA to address the increasing pressures of over-development upon the nation's coastal resources. At the Federal level, the National Oceanic and Atmospheric Administration administers the Act. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary, however, the state of New York has an approved coastal zone management program. The staff assumed that SERI would comply with all provisions of the CZMA as implemented in the Lake Ontario region. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the land-use impacts on the site and vicinity of construction and operations would be SMALL.

Transmission Line Rights-of-Way

The existing 345-kV transmission line right-of-way runs east-southeast from the FitzPatrick site, crossing rural forested and agricultural lands for approximately 112 km (70 mi), to a substation just north of Utica, New York. The existing transmission line right-of-way does not cross any land known to be protected or designated for special uses. Section 3.3 discusses the regulatory procedure required to link new large electrical generation facilities to the grid. The issues that could result in potential impacts of construction and operation in this transmission line right-of-way (i.e., physical and ecological impacts) would be similar to those land-use impacts of construction and operation in the transmission line rights-of-way associated with the Grand Gulf ESP site. However, the potentially affected right-of-way crosses land that is more densely populated than the Grand Gulf rights-of-way, therefore, the likelihood of conflicting uses may be greater. The staff assumed that zoning regulations also would be in place that may affect what activities can occur in the affected right-of-way. Therefore, the staff concludes that land-use impacts of transmission system construction associated with a new ESP facility could range from SMALL to MODERATE. For transmission system operations, impacts would be SMALL.

8.5.3.2 Water Use and Quality

Water Use

The FitzPatrick site is located adjacent to Lake Ontario. Construction activities for new nuclear unit(s) at the FitzPatrick site would have similar water usage impacts (i.e., physical and ecological impacts) as the construction at Grand Gulf and would be bounded by the operational impacts. During operation, the consumptive use of water from the cooling towers would be very small compared to the supply available in the lake. Therefore, the staff concludes that the impacts on water use and water supply at the FitzPatrick site would be SMALL.

Water Quality

Construction of new nuclear unit(s) at the site would follow best management practices and have similar water-quality impacts as the construction at Grand Gulf, and would be bounded by the operational impacts. The additional heat from the relatively small amount of blowdown water would be commingled with the discharge of the existing FitzPatrick Plant. This would marginally increase the size of the current thermal plume. Thermal and chemical discharges to Lake Ontario would be regulated by the New York State Department of Environmental Conservation via a State Pollutant Discharge Elimination System permit issued to protect the environment. Since the combined discharge represents a very small fraction of the water volume, the staff concludes that the impacts on water quality at the FitzPatrick site would be SMALL.

8.5.3.3 Terrestrial Resources Including Endangered Species

Construction Impacts

The FitzPatrick site's coastal zone is a transitional area between northern boreal forest and northeastern hardwood forest. The two ecosystems present in this coastal zone are wetlands and upland areas. The climax community is a deciduous forest with an extensive herbaceous ground cover. Much of the original mature forest land was cleared in the past for farming, and a great deal of farm land has since been abandoned. Consequently, the uplands are mostly second-growth communities in a variety of successional stages. Wetlands are attributable to relatively impermeable glacial till soils where perched groundwater lies at or near ground surface at least seasonally or during particularly wet years. Wetlands are, therefore, generally transitional and include shallow ponds, shrub swamps, wood swamps, and intermittently wet bottomland-like forests (NMPC 1983).

The FitzPatrick facility occupies the majority of the northwest quarter of the site. The northeast quarter and southern half of the site consist of forest, old fields, and remnant orchard trees.

These sections of the site also contain numerous freshwater forested/shrub wetlands, freshwater emergent wetlands, and freshwater ponds (Cowardin et al. 1979), totaling from about 24 to 32 ha (60 to 80 ac), representing an estimated 8 to 12 percent of the site. These wetlands range in size from 0.4 to 10 ha (1 to 24 ac), are widely scattered across the northeast quarter and the southern half of the site, and are part of the U.S. Fish and Wildlife Service (FWS) National Wetlands Inventory Database (FWS 2004c).

It is assumed that a new generating facility would be located in the northeast quarter or southern half of the site. In either of these areas, forests and old fields would be affected. Wetlands would also likely be affected because of their relatively uniform distribution across the northeast quarter and southern half of the site. Consequently, habitat impacts from construction of a new generating facility on the site would be expected to be substantial.

The potential impacts from construction, such as erosion and dust generation, would be typical of large construction projects. These impacts could be mitigated using standard industrial procedures and best management practices. Standard practices such as silt fences to control sedimentation and water sprays to limit dust generation would protect wetlands and other ecological resources in the vicinity.

One transmission line right-of-way, extending for a distance of 112 km (70 mi) (Section 8.5.3.1) and covering 400 ha (988 ac) (NRC 1996), currently serves the FitzPatrick plant. Land cover along the transmission line right-of-way consists of forest (63 percent); cropland and pasture (29 percent); wetlands (8 percent); and recreational areas, residential areas, and highways (less than one percent) (AEC 1973). It is assumed this transmission line right-of-way would not have the capacity to carry the power generated by a new facility and that a transmission system upgrade, including new transmission lines and an additional right-of-way, would be needed. It is assumed any additional right-of-way would involve an expansion, or doubling, of the existing right-of-way. Consequently, a substantial amount of forest habitat, 252 ha (622 ac), could be lost because of the expansion, and a substantial amount of wetland habitat could be affected.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on terrestrial ecological resources from construction of a new generating facility at the FitzPatrick site and associated expansion of the transmission line right-of-way would be MODERATE to LARGE.

Threatened and Endangered Species

No terrestrial animal or plant species that are Federally listed as threatened, endangered, or proposed for listing, and no associated designated or proposed critical habitat are known to occur in the vicinity of the FitzPatrick site (NYDFWMR 2004; FWS 2004d). No State-listed threatened or endangered terrestrial animal or plant species are known to occur within 3.2 km (2 mi) of the FitzPatrick site (NYDFWMR 2004).

Six State-listed threatened or endangered bird species are known to occur beyond 3.2 km (2 mi) but less than 16 km (10 mi) from the FitzPatrick site: Henslow's sparrow (*Ammodramus henslowii*), black tern (*Chlidonias niger*), northern harrier (*Circus cyaneus*), sedge wren (*Cistothorus platensis*), least bittern (*Ixobrychus exilis*), and pied-billed grebe (*Podilymbus podiceps*) (Table 8-11) (NYDFWMR 2004). Henslow's sparrow breeds and migrates in open fallow and grassy fields, sedge meadows, and pastures (NJDFW 2004a). The black tern breeds in inland marshes and sloughs with fairly dense marsh vegetation and pockets of open water (University of Michigan 2004). Northern harriers nest and feed in wet meadows, grasslands, abandoned fields, and coastal and inland marshes (MNHESP 1990d). The sedge wren inhabits wet meadows, freshwater marshes, bogs, and the drier portions of salt or brackish coastal marshes throughout the year (NJDFW 2004b). The least bittern inhabits freshwater marshes (MNHESP no date). The pied-billed grebe nests in marshes, lakes, large ponds, and other wetlands that have an abundance of marsh vegetation. They winter in open lakes and rivers, estuaries, and tidal creeks (MNHESP 1990e). Because forested wetlands are prevalent on the FitzPatrick site and along its transmission line right-of-way, the black tern, northern harrier, sedge wren, least bittern, and pied-billed grebe could occur there and could thus be affected by construction of a new generating facility and expansion of the existing right-of-way. Because old fields occur on the FitzPatrick site and cropland and pasture occur along the transmission line right-of-way, Henslow's sparrow could occur there and could thus be affected by construction of a new facility and expansion of the right-of-way.

All the above avian species, except for the black tern, have been reported in studies at the neighboring Nine Mile Point Nuclear Station (NMPNS), its transmission line right-of-way, and the Heritage Station site (a natural gas-fired combined-cycle generating facility located on Lake Ontario about 3.2 km (2 mi) southwest of NMPNS, which exhibits comparable wetland types and edaphic conditions) as potentially occurring in the general area. However, it is unlikely that any of these species nest on the NMPNS site, based on available habitat (Constellation Energy 2004). Further, these species do not appear in the results of a 1979 field survey of the NMPNS Unit 2 environs that included the FitzPatrick site (NMPC 1983). It, therefore, appears unlikely these species would use the FitzPatrick site for nesting.

Four State-listed threatened or endangered terrestrial plant species are known to occur beyond 3.2 km (2 mi) but less than 16 km (10 mi) from the FitzPatrick site: creeping sedge (*Carex chordorrhiza*), giant pine-drops (*Cypripedium arietinum*), little-leaf tick-trefoil (*Desmodium ciliare*), and swamp smartweed (*Polygonum setaceum interjectum*) (Table 8-11) (NYDFWMR 2004). Creeping sedge is a wetland obligate in the northeastern United States and is known to occur in wet sphagnum bogs (USGS 2004). Giant pine-drops occurs in damp

Table 8-11. Terrestrial State-Listed Species Occurring More than 3.2 Kilometers (2 Miles) but Less than 16 Kilometers (10 Miles) from the FitzPatrick Site

Scientific Name	Common Name	Status[(a)]
Birds		
Ammodramus henslowii	Henslow's sparrow	ST
Chlidonias niger	black tern	SE
Circus cyaneus	northern harrier	ST
Cistothorus platensis	sedge wren	ST
Ixobrychus exilis	least bittern	ST
Podilymbus podiceps	pied-billed grebe	ST
Plants		
Carex chordorrhiza	creeping sedge	ST
Cypripedium arietinum	giant pine-drops	SE
Desmodium ciliare	little-leaf tick-trefoil	ST
Polygonum setaceum interjectum	swamp smartweed	SE

(a) Status rankings developed by the New York State Division of Fish, Wildlife, and Marine Resources, SE = State endangered, ST = State threatened (NYDFWMR 2004).

or mossy woods or bogs, in conifer, hardwood, and mixed forests, and in forested wetlands (MDCNAP 2004d). Little-leaf tick-trefoil occurs in shrub succession areas with disturbed sands (NearActica 2005). Swamp smartweed occurs on the open shores of natural lakes and less frequently in swamp forests (ODNR 1998). Because forests and forested wetlands are prevalent on the FitzPatrick site and along its transmission line right-of-way, creeping sedge, giant pine-drops, and swamp smartweed could occur there and could thus be affected by construction of a new generating facility and expansion of the existing right-of-way. It appears unlikely that little-leaf tick-trefoil would occur on the FitzPatrick site or along its transmission line right-of-way because shrub succession areas are not known from there.

Surveys were conducted in 1991 and 1999 for State-listed threatened and endangered plant species at the Heritage Station site and none were found. Constellation Energy (2004) considers the results of these surveys to indicate that these plant species are unlikely to occur on the NMPNS site because the habitat types present are essentially the same. It is assumed the results of the Heritage site surveys would also apply to the neighboring FitzPatrick site.

Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts on threatened and endangered species from construction of a new generating facility on the FitzPatrick site and possible expansion of the existing transmission line right-of-way would be SMALL.

Operation Impacts

Impacts on terrestrial resources that may result from operation of one or more new nuclear units at the FitzPatrick site include those associated with cooling towers and transmission lines. The FitzPatrick plant currently employs a once-through cooling system, but cooling towers would be employed for a new nuclear unit(s). The impacts of cooling tower drift and bird collisions for existing power plants were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with multiple cooling towers of various types. The staff is not aware of any new information that would cause it to modify its earlier conclusions. On these bases, for the purposes of consideration of alternative sites, the impacts of cooling tower drift and bird collisions with cooling towers resulting from operation of one or more new nuclear units at the FitzPatrick site likely would be negligible.

For both natural and mechanical draft cooling towers, the noise level from cooling tower operation is anticipated to be 55 dBA at 300 m (1000 ft) (SERI 2005). The noise level for dry cooling towers is somewhat higher. However, these noise levels are all well below the 80- to 85-dBA threshold at which birds and small mammals are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the FitzPatrick site would not be likely to disturb wildlife beyond 300 m (1000 ft) from the source. Further, impacts within this distance, if any, would be considered negligible owing to the large expanses of open habitat into which mobile wildlife species could move if disturbed. Consequently, the impacts of cooling tower noise on wildlife from operation of one or more new nuclear units at the FitzPatrick site would be minimal.

The impacts usually associated with transmission line operation consist of bird collisions with transmission lines. The staff assumes that the addition of new lines for expansion of the transmission system for one or more new nuclear units at the FitzPatrick site would present few new opportunities for bird collisions, and that no measurable reduction in local bird populations would result. The issue of bird collisions with transmission lines was evaluated previously in the GEIS (NRC 1996) and was found to be small for all facilities, including those with multiple transmission line rights-of-way with various numbers of transmission lines. Based on the above rationale and the associated conclusions presented in GEIS (NRC 1996), the effects of bird collisions with transmission lines for one or more new nuclear units at the FitzPatrick site would be negligible.

The impacts usually associated with transmission right-of-way maintenance (cutting and herbicide application) consist of erosion/siltation and disturbance of wildlife and wildlife habitat, and similar impacts where transmission line rights-of-way cross floodplains and wetlands. The staff assumes that right-of-way maintenance would be conducted similar to current operations, only over a wider area. The effects of right-of-way maintenance were evaluated previously in the GEIS (NRC 1996) and were found to be small for all plants, including those with transmission line rights-of-way of various widths. The staff is not aware of any new information that would cause it to modify its earlier conclusion. Therefore, general wildlife and wildlife habitat would be expected to be minimally affected by right-of-way maintenance in transmission line rights-of-way expanded for one or more new nuclear units at the FitzPatrick site.

The staff reviewed the operation of one or more nuclear units at the FitzPatrick site, including the associated heat-dissipation system and transmission line operation and right-of-way maintenance. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts of operation of one or more nuclear units at the FitzPatrick site on terrestrial resources and threatened and endangered species would be SMALL.

8.5.3.4 Aquatic Resources Including Endangered Species

Construction and Operation Impacts

The aquatic resources near the FitzPatrick site would not be expected to be affected by the construction and operation of a new nuclear facility and associated cooling towers. The existing FitzPatrick intake structure in Lake Ontario would be sufficient for additional water withdrawals for proposed cooling towers. This system includes an acoustic deterrent system on the intake structure to discourage fish from approaching the inflow region, an approach that is considered best available technology for discouraging impingement of aquatic organisms. Intake and discharge flow to Lake Ontario would not increase substantially because the new facility would use closed-cycle cooling. Impingement, entrainment and heat shock from the current system are not expected to increase substantially for the operation of new nuclear units. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impacts on aquatic ecological resources from construction and operation of one or more new nuclear units and associated cooling towers at the FitzPatrick site would be SMALL.

Threatened and Endangered Species

No Federally listed or proposed threatened and endangered species are found within the vicinity of the FitzPatrick site. The FWS and NOAA Fisheries did not identify any Federally listed threatened or endangered species, except for the occasional transient individual, in the vicinity of the FitzPatrick site (FWS 2004d; NMFS 2004).

The New York State Division of Fish, Wildlife, and Marine Resources (2004) has listed three species of fish that are listed as endangered that might be in the region of the FitzPatrick site: lake sturgeon (*Acipenser fulvescens*), deepwater sculpin (*Myoxocephalus thompsoni*), and round whitefish (*Prosopium cylindraceum*) (Table 8-12). Mature adult lake sturgeon average between 0.9 to 1.5 m (3 to 5 ft) in length and 4.5 to 36 kg (10 to 80 lbs) in weight. They have a torpedo-shaped body and a sharp, cone-shaped snout. The top and side bony plates (called scutes) are the same color as the dull grey body. Lake sturgeon spawn in the spring from May to June in areas of clean, large rubble such as along windswept rocky shores of islands and in rapids in streams. Lake sturgeon are bottom feeders, eating leeches, snails, clams, other invertebrates, small fish, and even algae. The cause for the decline of lake sturgeon in Lake Ontario is uncertain. The New York Department of Environmental Conservation has been trying to reestablish populations of lake sturgeon in selected tributaries of Lake Ontario (NYSDEC 2003b).

Table 8-12. State-Listed Threatened or Endangered Aquatic Species Reported Within a 16-Kilometer (10-Mile) Radius of the FitzPatrick Site

Scientific Name	Common Name	Status[(a)]	Distance from the River Bend Site[(b)]	Source
Fish				
Acipenser fulvescens	lake sturgeon	SE	16 km (10 mi)	NYDFWMR 2004
Myoxocephalus thompsoni	deepwater sculpin	SE	16 km (10 mi)	NYDFWMR 2004
Prosopium cylindraceum	round whitefish	SE	16 km (10 mi)	NYDFWMR 2004

(a) Status rankings developed by the New York State Division of Fish, Wildlife, and Marine Resources, SE = State endangered, ST = State threatened (NYDFWMR 2004).

The deepwater sculpin ranges from 0.05 to 0.12 m (2 to 4.7 in.) in length, and is New York's largest sculpin species. The fish has a long, tapered body, a blunt snout and a flat head. The deepwater sculpin spawns year round and is usually found in deep, cold water. It was abundant in Lake Ontario until 1980, after which the population declined to the point where it was considered extirpated from the lake until it was collected in the late 1990s. The cause of the sculpins' population decline is unknown but may be related to competition and predation with alewives (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*) (NYSDEC 2003a).

Round whitefish are a medium-sized fish, averaging 0.2-0.3 m (8-12 in.) in length. The shape of the fish is long and tubular with a nearly round midsection (hence its name). Round whitefish are bottom feeders, and they eat a variety of invertebrates, small fish, and fish eggs. Round whitefish spawn in the fall (November-December) over gravel shoals of lakes or at river mouths (NYSDEC 2003c).

None of these State-listed endangered fish species have been reported in the extensive lake sampling and impingement monitoring efforts at FitzPatrick, nor at the nearby Nine Mile Point Nuclear Station and Oswego Steam Station. The lake sampling efforts were conducted through the 1970s until 1981. The impingement and entrainment studies have been conducted through 1997 (Constellation Energy 2004).

Based on the information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impact on threatened and endangered aquatic species from construction and operation of one or more new nuclear units and associated cooling towers at the FitzPatrick site would be SMALL.

8.5.3.5 Socioeconomics

In evaluating the socioeconomic impacts of construction at the FitzPatrick site, Entergy undertook a "reconnaissance" survey of the site using readily obtainable data from the Internet or published sources. The NRC staff did the same and also conducted some local interviews with knowledgeable local officials. No new data were collected. The socioeconomic subsections follow the organizational structure of the socioeconomic discussions in Sections 2.8, 4.5, and 5.5. The impacts expected from both construction and station operation are discussed.

Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting, and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. However, extensive work is planned to the existing roads or railways, and new routes are being built to reduce existing bottlenecks in the regional highway system, so no physical impacts on the existing road net are expected. It is expected that all construction activities would occur within the existing FitzPatrick site. Offsite areas that would support construction activities (borrow pits, quarries, and disposal sites, for example) are expected to be already permitted and operational. Impacts on those facilities from construction of the new unit(s) would be a small incremental impact associated with their normal operation.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. The new unit(s) would produce noise from the operation of pumps, cooling tower fans, transformers, turbines, generators, and switchyard equipment, and noise from traffic. New York regulations or guidelines regarding noise limits were revised February 2, 2001 (NYSDEC 2001). SERI states in its environmental report (SERI 2005) that any noise coming from the Grand Gulf site would be controlled in accordance with standard noise protection and abatement procedures. By inference, this is also expected to apply to the FitzPatrick site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the ESP site (SERI 2005).

The new unit(s) would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions are in compliance with regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the new unit(s) would not use significant quantities of chemicals that could generate odors that exceed olfactory threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce (SERI 2005).

Construction activities would be temporary and would occur mainly within the boundaries of the FitzPatrick site. Offsite impacts would represent small incremental changes to offsite services that support the construction activities. During station operations, noise levels would be managed to local ordinances. Air quality permits would be required for operation of the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by SERI and the NRC staff's independent review, the staff concludes that the physical impacts of construction and operation would be SMALL.

Demography

The population base potentially affected is considered to be the population of significant population centers within 80 km (50 mi) of the FitzPatrick site. The population of Oswego County is about 122,000 (USCB 2004). The estimated population within 80 km (50 mi) of the FitzPatrick site is slightly over 943,000 (NRC 2004b). The populations of the 10 counties within 80 km of the FitzPatrick site are projected to decline by approximately 6 percent by the year 2030 (NYSIS 2002).

Most (70 percent) of the estimated resident construction workforce of 2835 is expected to come from within the region, and those who might relocate to the region (up to 2360 people) would represent a small percentage of the larger population base (Entergy Nuclear 2001). While some of the station operation workforce is expected to relocate into the region, their numbers are small (an unknown percentage of 1160 new operating employees and their families) when compared to the total base population, and their locations of residence would probably be distributed throughout the region. Based on the information in SERI's environmental report (SERI 2005), the Early Site Permit Selection Committee Notebook (Entergy Nuclear 2001) prepared by Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the demographic impacts within an 80-km (50-mi) radius of the FitzPatrick site attributable to construction and operation would be SMALL.

Social and Economic Impacts

Economy

The FitzPatrick site is located in an economic area of New York that is in the process of reinvention and renewal that is organized around clusters of businesses in energy, health care, manufacturing, and outdoor recreation. The Syracuse labor market area (Oswego, Onodaga, Cayuga, and Cortland Counties) had an unemployment rate of 5.3 percent in August 2004, while the unemployment rate in Oswego County was somewhat higher at 7.7 percent (NYSDOL 2004). The economy within the an 80-km (50-mi) radius of the FitzPatrick site is diverse and mature, with major manufacturing employment in paper and primary metals and service companies in many sectors. The Oswego area has lost several major manufacturing plants over the past few years (for example, Néstle in 2003), and community leaders are now working hard to replace these jobs and further diversify the local economy. The local economic development leaders consider additional nuclear unit(s) at the FitzPatrick site to be highly compatible with the current economy and their economic plans for the county (Scott 2004b). Regionally, the service sector now offers the most employment opportunities. The construction and operation of one or more new nuclear units at the FitzPatrick site would be expected to add to the prosperity of the region, especially Oswego County.

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff reviewed the impacts of station construction and operation on the economy of the region and concludes that the impacts would only be significant in Oswego County where the impacts could be positive and noticeable. Much of the economic impacts would be diffused in the larger economic bases of the central New York region. With the smaller economic base of Oswego County, the economic impacts would be more noticeable.

Entergy Nuclear estimates it would take 3150 construction workers 5 years to build one or more new nuclear units at the FitzPatrick site (Entergy Nuclear 2001). SERI is expected to be able to attract the necessary workforce for construction activities at the site because of its proximity to the major population center of Syracuse, with additional workers available in the Watertown, Utica-Rome, and Rochester areas. The availability of craft workers for regular construction projects of longer duration is reported to be good. In the year 2002, about 12,500 construction workers were employed in the Syracuse labor market area, with several thousand more located within an 80-km (50-mi) radius of the FitzPatrick ESP site (NYSDOL 2004).

The addition of new unit(s) would require an increase in the operations workforce of approximately 1160 employees. Currently, approximately 700 permanent employees work at the FitzPatrick site (SERI 2004c). In its site comparison study, Entergy Nuclear did not state what percentage of the operations labor force for the new unit(s) would relocate from outside the region (Entergy Nuclear 2001). Some defense nuclear sites are reducing their workforces as they change missions, and workers from these sites could be potential pools of labor for the operating workforce at the new FitzPatrick reactors.

Construction labor would be readily available from within the region, and there should be little problem recruiting the required labor skills to enable construction of the nuclear unit(s) at the FitzPatrick site. Some of the operations workforce likely would already be in the region.

Taxes

Construction and operations workers would pay income, sales, and use taxes to New York and the local governments in the region where sales take place, and property taxes to the counties and school districts in which they own a residence. Sales and use taxes would be applied to the sales of construction materials and supplies purchased for the project and to purchases made by the construction and operations workforce for goods and services. SERI has made no estimate of the day-to-day expenditures that would be made in the region during construction. During operations, the current plant generates about $150,000 per year in sales and use taxes (Oswego County Business Magazine 2001). Corporate income taxes on profits would also be paid by companies engaged in construction at the site.

New York has no personal property tax (Empire State Development 2002), so no tax would be paid by companies on the value of equipment used during construction of any new nuclear unit at the site. The local property tax impact is the real property taxes levied for the incremental increase in value to the entire site from the operation of the additional unit(s). The increase in value would depend on how the eventual agreements on assessed value are reached. It is expected that Oswego County, the town of Scriba, and the Mexico School District would be the only beneficiaries of the these taxes. Entergy Nuclear FitzPatrick, LLC currently has a significant impact on the tax revenue of governmental entities in Oswego County, paying $436,000 to the town of Scriba (out of a budget of roughly $4.2 million), $2.9 million to Oswego County (out of $50 million total property taxes and payments in lieu of taxes and $150 million total revenues raised), and $3.9 million to the Mexico School District (out of $9.1 million from local sources and $31.7 million total from 2001 to 2002) (SERI 2004c; Constellation Energy 2004; Oswego County 2004; NYSED 2004).

Based on the information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the overall impacts from construction and operation of taxes collected through the income, sales and use, and property taxes would be noticeable in Oswego County, Mexico School District, and town of Scriba, but not noticeable elsewhere. The taxes paid, while substantial, are nevertheless a small sum when compared to the total amount of taxes collected by New York and local governments in the 80-km region surrounding the site. Depending on the outcome of tax negotiations between Entergy and the state of New York on the amount of property taxes, the staff considers the overall impacts of the property taxes collected in Oswego County would be significant and beneficial relative to the total amount of taxes the county collects through property taxes.

Summary of Social and Economic Impacts

Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on social and economic resources from construction and operation of new nuclear unit(s) at the FitzPatrick site would be MODERATE beneficial to SMALL beneficial.

Infrastructure and Community Services

Transportation

The general area around the FitzPatrick site is served by several major highways, including Interstate 90, Interstate 81, and State Highway 481. Oswego is about a 10-minute drive from the site on good, straight, two-lane roads. The principal road access to the FitzPatrick site is via County Roads 1 and 1A (Lake Road), which is a two-lane paved road.

The construction of new reactors would require additions to the workforce. In addition, construction material, waste, and excavated material would be transported both to and from the site. These activities would result in increases in operation of personal-use vehicles by commuting construction workers, in commercial truck traffic, and in traffic associated with daily operations.

Although neither state nor local governments have level-of-service information for county roads in the state of New York, a capacity analysis of area intersections was performed as part of the application for Certification of a Major Generating Facility Under Article X of the New York State Public Service Law for the proposed natural gas-fired Heritage Station, approximately two miles west of the neighboring Nine Mile Point nuclear site. In the study, the average count for the segment of County Road 1A from County Road 1 to Lakeview Road was 4900 in 1995. Level-of-service ratings of the approaches for the two intersections closest to the Nine Mile Point site along County Road 1A for peak use hours ranged from "A" to "C," with one approach having an "F" rating; however, the majority of approaches carried an "A" or "B" rating (Constellation Energy 2004). The level-of-service designation on nearby county roads would likely be degraded (as individual users are significantly affected by interactions with the traffic stream) during the peak construction period for new nuclear reactors at the FitzPatrick site.

Direct rail access is available from CSX Corporation to the FitzPatrick site, so large equipment and bulk deliveries could be sent via that mode of transportation. There is also a barge slip at the site that could be used for large equipment

The Oswego County Airport and the Syracuse-Hancock International Airport serve the area. The airport in Syracuse provides regular freight and passenger jet services and is of sufficient size to accommodate the relatively small air shipments normally associated with a construction project.

The impacts of station operation employees on the transportation system would be less than that incurred during construction of the ESP units. However, there would be increases in personal-use vehicles by commuting operations staff. Portions of County Road 1, County Road 1a, and New York State Route 104 may be affected by commuters to the plant site, particularly during shift changes. No level-of-service or traffic count information appear to be readily available for these roads in the vicinity of the FitzPatrick site. County Road 1 was recently upgraded. Route 104 to New Haven and the town of Mexico is due to be upgraded in 2007 to remove current congestion (Scott 2004b). A degraded level of service indicates that the freedom to select speed or freedom to maneuver is diminished.

Based on a review of information provided by SERI, Entergy Nuclear, and its own reconnaissance-level review, the staff concludes that the impacts of a construction workforce and related transportation of construction supplies and materials on the transportation infrastructure at the FitzPatrick site would be noticeable but temporary. Some of the local roads could have their level of service degraded during construction. Much of the Oswego County road network has been improved for heavy trucks; however, if heavy loads are carried by vehicles transporting construction materials to the FitzPatrick site, some of the roads may need additional repair. The impacts of the operations workforce and related transportation impact likely would be less. There may be some minor congestion at shift changes.

Recreation

The FitzPatrick site is clearly an industrial site with nearby lake and state park recreation. The Nine Mile Point reactor site (nearby) already has cooling towers, so new towers would not create much of a change. Traditionally, visible plumes generated by the operation of cooling towers could cause a negative aesthetic effect on recreation. As long as any new transmission lines are confined to (possibly expanded) existing rights-of-way, as assumed in Section 8.5.3.3, the aesthetic effects of new transmission lines are not likely to be significant. Based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the impact of construction and operation on aesthetics in the vicinity of the FitzPatrick site would not be significant.

Housing

Of the 3150 construction workers needed to build one or more new nuclear units at the FitzPatrick site, Entergy Nuclear expects that virtually all would be available from the major nearby population centers of Syracuse, Watertown, Utica-Rome, and Rochester (Entergy Nuclear 2001). A 13.8 percent vacancy rate out of a total 52,800 housing units existed in Oswego County at the 2000 U.S. Census (USCB 2004). The housing market in the Oswego area has been “soft” since about 1993 (Scott 2004b). Given the proximity of the FitzPatrick site to the Oswego metropolitan area, housing for any additional construction workers, most of whom will be coming from within the region, and the operations workforce is expected to be available. During operations, Oswego County and the Oswego area could easily support additional housing (Scott 2004b).

Based on the information provided by SERI, Entergy Nuclear, and the NRC staff’s independent review, the staff concludes that the impacts of a construction and operations workforce on the demand for housing and housing availability would be a modest positive development in what is currently a soft housing market. The conclusion is based on approximately 7300 vacant housing units in Oswego County, existing construction plans, and the proximity of the FitzPatrick site to the larger Syracuse metropolitan area.

Public Services

Water Supply and Waste Treatment. There are 29 public water districts in Oswego County. These districts cover the cities of Fulton and Oswego and the towns of Central Square, Cleveland, Mexico, Phoenix, Pulaski, Sandy Creek, and Lacona, as well as portions of the surrounding towns. The total population served is over 50,870, which is over 40 percent of the total population of the county (the remainder use private wells). These districts obtain their water from a variety of sources, including directly from Lake Ontario, local wells, and water purchased from the Onondaga County Water Authority. The main water sources for the public water districts are Lake Ontario and a variety of groundwater aquifers and associated springs (Oswego County Department of Planning and Community Development 2000). While there are districts close to their capacity, in general the decline of manufacturing in the county and several additions to capacity over the years mean that substantial excess capacity is available.

Most of the construction workforce would come from within the region, so they are already accounted for in the demands being placed on the local water systems. The station operating workforce, while relocating to the region, would probably reside throughout the region, so they would not particularly affect any one community or jurisdiction. Based on the NRC staff’s independent review, the staff concludes there would be no noticeable impact of construction and operation on water supply treatment facilities.

Police, Fire, and Medical Facilities. In the larger area of Oswego County, and the towns of Texas, Mexico, Syracuse, and in nearby Oswego itself, police, fire, and medical facilities would not be affected materially by an increase in the construction workforce. Many of the construction workers are anticipated to live in the region already and would commute to the FitzPatrick site. As a result, these workers are being served by existing police, fire, and medical services and facilities already.

An unknown percentage of the approximately 1160 operations workers and their families is anticipated to come from outside the region. Most likely they would reside throughout the region and would not concentrate as a group in any one place or jurisdiction. Should this occur, there should not be any significant additional demands placed on these services and facilities.

Social Services. A variety of social services in New York are provided in each county by the New York Department of Family Assistance, Office of Mental Health, Office for the Prevention of Domestic Violence and others (New York State Citizen Guide 2005). During construction at the FitzPatrick site, there may be an increased demand for some social services.

Generally, construction and operation of one or more new nuclear units at the FitzPatrick site would be viewed as beneficial economically to the disadvantaged population segments served by the New York Department of Social Services. The new workforce that would be associated with the FitzPatrick site would be relatively higher paid than workers in other employment categories in the region. Construction and operation of new unit(s) should increase employment, through the multiplier effect (see Section 4.5.3.1) and may enable the disadvantaged population to improve their social and economic position by moving up to higher paying jobs. At a minimum, the expenditures of the construction and operations workforce in the counties for goods and services could, through the multiplier effect, increase the number of jobs that could be filled by members of the disadvantaged population. Noticeable new demand for social and related services as a result of construction and operation of the new facility is unlikely. Construction and operation would have a beneficial impact on the economically disadvantaged population of the region, which should lessen the demand for social services. There could be an initial increase in demand for social services at the beginning of the construction period, but this increased demand is considered manageable and limited.

Education

The 10 Oswego County school systems have just over 25,300 students, and private schools enroll another 460 students (NCES 2004a). The school districts for the city of Oswego and the town of Mexico in particular have taken advantage of recently conferred payments in lieu of taxes on the existing FitzPatrick and Nine Mile Point nuclear plants to upgrade facilities. There currently is no overcrowding in the systems, and the Oswego and Mexico school systems enjoy some of the lowest teacher-to-student ratios in the state of New York, high standardized test performance (top 10 in New York State), and excellent facilities (Scott 2004b). In the other counties and cities of the region, it is anticipated that the construction and operations workforce would minimally impact school infrastructure. The reasons are that many construction workers already live within the region. Entergy Nuclear estimates that new population drawn to the region during construction would be 2360 persons (Entergy Nuclear 2001), 661 of whom are likely to be children. The unknown percentage of the operations workforce moving from outside and relocating into the region would probably be distributed throughout the region, thus placing little demand on school infrastructure as a result.

It is anticipated that most of the construction workforce would come from within the area and would not relocate their families. Those construction and operations workers potentially relocating to the region would most likely reside throughout the region and, as a result, would not be in sufficiently concentrated groups to place an undue burden on the existing infrastructure.

Summary of Infrastructure and Community Services

Based on information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that impacts on infrastructure and community services from construction and operation of new nuclear unit(s) at the FitzPatrick site would be SMALL to MODERATE.

Summary of Socioeconomics

In summary, based on the information provided by SERI, Entergy Nuclear, and the NRC staff's independent review, the staff concludes that the socioeconomic impacts of the construction and operations on the region surrounding the FitzPatrick ESP site would be SMALL with the following exceptions. The impacts on the economy of Oswego County would be MODERATE beneficial, and the impacts on the tax bases of the three nearest taxing jurisdictions would be MODERATE beneficial to SMALL beneficial during construction and MODERATE beneficial during operations. The impacts on transportation near the plant during construction would likely be MODERATE adverse during construction. Some additional transportation upgrades may be necessary.

8.5.3.6 Historic and Cultural Resources

The footprint for proposed new reactors at the FitzPatrick site does not appear to have any historic properties located within areas that are likely to be affected by new construction and operation. Previous investigations indicate that no historic properties exist on the site (AEC 1973). Protective measures would be implemented in the event that historic or archaeological materials are discovered during construction or during operations. In the event that an unanticipated discovery is made, site personnel would be instructed to notify the State

Historic Preservation Officer and would consult with him or her in conducting an assessment of the discovery to determine if additional work is needed.

There are no significant differences between the Grand Gulf ESP site and the FitzPatrick site that would make any material difference in the potential for historic properties or other important cultural sites to be adversely affected. Based on information provided by SERI, Entergy, and the NRC staff's independent review, the staff concludes that the impacts would be SMALL.

8.5.3.7 Environmental Justice

As part of the evaluation of the potential environmental justice impacts related to the FitzPatrick site, the staff used information from U.S. Census Bureau (USCB 2004), SERI (2005), Entergy Nuclear (2001), interviews with local officials (Scott 2004b), and the NRC staff's independent review of local conditions. The Oswego County area has relatively few minority residents (3.5 percent of the population), and no concentrations of minority residents. Concentrations of minority residents within 80 km are mostly found at some distance from the FitzPatrick site, in the Syracuse and Rome-Utica areas. There are two (non-minority) low-income census block groups within the city of Oswego, but no others in the county (NRC 2004b). The pathways through which the environmental impacts associated with the construction of one or more new nuclear units at the FitzPatrick site could affect human populations were ascertained. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations.

Based on the information provided by Entergy Nuclear, SERI, interviews, and the NRC staff's independent review, the staff concludes that the offsite impacts of construction and operation of one or more new units at the FitzPatrick site to minority and low-income populations would be SMALL. No adverse and disproportionately high impacts were identified.

8.5.4 Generic Impacts Consistent Among Alternative Sites

In evaluating the alternative sites, the staff found certain impact categories would not vary among sites, and, as a result, would not affect the evaluation of whether an alternative site is environmentally preferable to the proposed site. These areas include air quality; nonradiological and radiological effects on members of the public, workforce, and biota; postulated accidents; and hydrological alterations. As a result, the impacts of these five areas are not evaluated as part of the site-specific alternatives analysis. Instead they are discussed generically in the following subsections.

8.5.4.1 Air Quality Impacts

Some minor impacts on air quality are likely to occur during construction at the Grand Gulf ESP site or any of the alternative ESP sites. The impacts will result from fugitive dust emissions from general construction activities. Elevated ambient air quality levels might also result from the automotive emissions of workforce traffic and emissions from construction equipment. These impacts, which are discussed in Section 2.3.2, are not likely to vary significantly among the Grand Gulf ESP site and the three alternative sites. In its environmental report, SERI (SERI 2005) stated with respect to construction at the proposed ESP site that "...controls would be initiated to keep air emissions within applicable government standards during construction." Although the environmental report does not address the impacts of construction at the alternative sites on air quality, the staff would expect SERI to make a similar commitment for construction at any site. Controls discussed include dust emission controls, burning controls, and engine emission controls.

Air quality at the Grand Gulf ESP site, the FitzPatrick Nuclear Power Plant, and the River Bend Station alternative sites is good. None of these sites is in an area that is designated as in nonattainment of National Ambient Air Quality Standards for any of the criteria air pollutants (40 CFR Part 81). The staff concludes that the impacts of construction activities on air quality at these sites would be SMALL because of the limited duration of the construction activities and the use of best management practices to limit dust and emissions.

The area around the Pilgrim Nuclear Station alternative site is designated nonattainment for both the 1-hour and 8-hour ozone standards. Ozone is associated with emissions from vehicles. Federal agencies are required by 40 CFR Part 93 to prepare a written conformity analysis where the total of direct and indirect emissions caused by a proposed Federal action would exceed established threshold emission levels in a nonattainment area. Estimation of direct and indirect emissions is beyond the scope of reconnaissance-level information. For the purpose of evaluating alternative sites, the staff assumes that the construction workforce for the Pilgrim Nuclear Station alternative site would come from the local area because of the relatively large population of the area. Consequently, construction of the ESP facility at the Pilgrim Nuclear Station site would not result in a large increase in vehicle emissions in the area. On this basis, the staff concludes that the impacts of construction at the Pilgrim Nuclear Station site would also be SMALL.

The air quality impacts from operating the ESP facility at the proposed site or at any of the alternative sites would be limited to those resulting from operation of wet cooling towers, such as visible plumes, and pollutant emissions from periodic operation of auxiliary boilers and generators. The impacts, which are discussed in Section 5.2 of this EIS, would be similar at the four sites. SERI would require approval under the existing Federal, State, or local air quality laws and regulations.

8.5.4.2 Nonradiological Health Impacts

Nonradiological health impacts from construction of the proposed unit(s) on the construction workers at all the alternative sites would be similar to those evaluated in Section 4.8. The impacts would include noise, odor, vehicle exhaust, and dust emissions. Plant construction would be in compliance with all applicable State regulations regarding fugitive dust emissions and air pollution control. Two out of three of the alternative sites (River Bend Station and FitzPatrick Nuclear Power Plant) are in rural areas, and construction impacts would be minimal on the surrounding population. For the third site, Pilgrim Nuclear Station, mitigative actions can be taken to minimize the impacts of construction on the population. The staff concludes that health impacts on construction workers and the public resulting from the construction of the new unit(s) at any of the alternative sites would be SMALL.

Occupational health impacts on operational employees would be the same for all the alternative sites. Thermophilic microorganisms would not be a concern at alternative sites for any facilities using either type of cooling towers. Health impacts on workers from noise would be similar among the sites. Noise would be monitored and controlled in accordance with applicable U.S. Occupational Safety and Health Administration regulations. The staff concludes that the occupational health impacts on construction or operations employees of proposed unit(s) at any of the alternative sites are expected to be SMALL.

With respect to transmission systems, the potential exists for impacts on members of the public from operation of the transmission system in terms of electrical shock, electromagnetic field (EMF) exposure, noise, and aesthetics. The impacts at the alternative sites would be similar to that evaluated in Section 5.8. The staff expects that all transmission lines, either constructed or used as part of an existing nuclear site, would meet standards established by the most current version of the National Electrical Safety Code (IEEE 2001).

8.5.4.3 Radiological Health Impacts

Exposure pathways for gaseous and liquid effluents from the proposed new unit(s) at the Grand Gulf ESP site would be similar for the alternative locations. Gaseous effluent pathways would include external exposure to the airborne plume, external exposure to contaminated soil, inhalation of airborne activity, and ingestion of contaminated agricultural products. Liquid effluent pathways would include ingestion of aquatic foods, ingestion of drinking water, external exposure to shoreline sediments, and external exposure to water through boating and swimming.

Radiation Doses and Health Impacts on Members of the Public

Section 5.9 provides an estimate of doses to the maximally exposed individual (MEI) and the general population for the Grand Gulf ESP site during routine operations for both the liquid effluent and gaseous effluent pathways. The same bounding liquid and gaseous effluent releases would be used to evaluate doses to the MEI and the population at each alternative site. However, there would be differences in the estimated doses at each of the sites. The differences would be caused by the use of site-specific atmospheric and water dispersion data, different exposure pathways, and site-specific population data used in the dose calculations.

Section 4.9 shows that the estimated dose to the MEI (occupational workers during construction) at the Grand Gulf ESP site would be well within the design objectives of 10 CFR Part 50, Appendix I. Considering the differences in pathways analyzed, atmospheric and water dispersion factors, and population size, doses estimated to the MEI for the alternative sites would also be expected to be well within the design objectives in Appendix I of 10 CFR Part 50. Population doses within 80 km (50 mi) of those alternative sites that are closer to major population centers (such as Pilgrim Nuclear Station) would be higher than for the Grand Gulf ESP site; however, the dose would still be small compared to the population dose from natural background radiation.

Based on the evaluation submitted by SERI (2005) and the NRC staff's independent evaluation, the staff concludes that annual doses to the public from the proposed system would be well within regulatory limits, and there would be no observable health impacts on the public from construction and normal operation of one or more nuclear units at the Grand Gulf ESP site or at any of the alternative sites. Therefore, the staff concludes that radiation doses and resultant health impacts from operation of the proposed new reactors at the alternative sites are expected to be SMALL.

Occupational Doses to Workers

Occupational doses would be approximately the same for workers at nuclear facilities at any of the alternative sites. The same (accumulated) annual occupational dose estimates of 1.5 person-Sv (150 person-rem) would be expected for all the proposed units regardless of the site location. The advanced reactor design proposed for construction and operation at the ESP site would result in less annual occupational exposure than that received by workers at currently operating reactors. The staff concludes that the occupational radiation doses from operation of the proposed ESP facility at the alternative sites would be SMALL.

Impacts on Biota

Table 5-9 provides the annual whole body dose estimates to surrogate biota species for the proposed new unit(s) at the Grand Gulf ESP site. The estimated doses to the biota were well within the guidance developed by the International Commission on Radiological Protection (ICRP 1977, 1991), the International Atomic Energy Agency (IAEA 1992), and the National Council on Radiation Protection and Measurements (NCRP 1991). The staff reviewed the available information relative to the radiological impact on biota, other than man, and performed an independent estimate of dose to the biota. The staff concludes that no measurable radiological impacts on populations of biota would be expected from the radiation and radioactive material released to the environment as a result of the routine operation of the proposed facility, or of operation at any of the alternative sites. The staff also concludes that impacts on biota of radiation doses from the operation of new reactors at the alternative sites would be SMALL.

8.5.4.4 Postulated Accidents

A suite of design basis accidents (DBAs) has been considered for new nuclear unit(s) at the Grand Gulf ESP site. The evaluation involved calculation of doses for specified periods at the exclusion area and low population zone boundaries, and comparison of those doses with doses based on regulatory limits and guidelines. Similar analyses have not been conducted for the alternative sites. Had such evaluations been conducted, the differences in the results would only have resulted from meteorological conditions and the distances to the site boundaries. The release characteristics would have been the same at all sites.

For the Grand Gulf ESP site, the doses for each accident sequence considered were well below the corresponding regulatory limits and guidelines. The Grand Gulf ESP site and the three alternative sites have similar climatological settings (mid-latitude, non-tropical, gently rolling terrain) and are sufficiently similar that it is highly unlikely that differences in local meteorological conditions would be sufficient to cause doses from DBAs for new nuclear unit(s) at any of the alternative sites to exceed regulatory limits or guidelines. Similarly, because each of the alternative sites is located at a nuclear reactor site, it is unlikely that differences in distances to the exclusion area and low population boundaries would be sufficient to cause doses from DBAs for new nuclear units at any of the alternative sites to exceed regulatory limits or guidelines. Therefore, the staff concludes that for the purposes of consideration of alternative sites, the impacts of DBAs at each of the alternative sites are SMALL.

A detailed analysis of the potential consequences of severe accidents for the postulated plants has been conducted for the Grand Gulf ESP site. Similar analyses have not been conducted for the alternative sites. Had such evaluations been conducted, subtle differences in the results would result from site-specific factors such as meteorological conditions, population distribution, and land-use distribution. The release characteristics would have been the same at all sites.

The probability-weighted consequences estimated for severe accidents for new nuclear units at the Grand Gulf ESP site are well below the consequences estimated for severe accidents at current generation reactors (see Section 5.10). For the purposes of license renewal, the staff has determined the probability-weighted consequences of severe accidents is SMALL for all existing plants (10 CFR Part 51, Subpart B, Table B-1). On this basis, the staff concludes that, for the purposes of consideration of alternative sites, the impacts of severe accidents at each of the alternative sites would be SMALL.

8.5.4.5 Hydrological Alterations

Construction of any major industrial facility would alter the local patterns of surface water runoff and groundwater recharge. Detailed designs are not available for an ESP facility at the alternative sites. However, because of hydrologic changes associated with the currently operating facilities and best management practices at these sites, the staff concludes that the incremental impacts on local hydrology would be small.

Facilities at the three alternative sites would use major water bodies as the source of makeup water and the sink for blowdown water. As at the Grand Gulf ESP site, a new nuclear facility at the River Bend site would rely on the Mississippi River for cooling water. New nuclear facilities at the Pilgrim or FitzPatrick sites would rely on the Atlantic Ocean and Lake Ontario, respectively, for cooling water needs. These water bodies are so vast compared to the water fluxes associated with a nuclear plant that any changes to the flow patterns of the water bodies would be small and localized. Therefore, the staff concludes that the impacts of hydrological alterations to surface water of these alternative sites would be small.

Consumptive water use of groundwater for facility water needs other than cooling (e.g., potable, demineralized) could affect the water table at the site. The staff concludes that if the potential impacts on groundwater were significant, these groundwater needs could be eliminated by treating water from the surface water sources instead of using groundwater.

Based on the above discussion, the staff concludes that the impacts of hydrological alterations, from construction and operation of a new nuclear facility at one of the alternative sites is generic and would be SMALL.

8.5.4.6 Ecological Impacts

Impacts on terrestrial flora and fauna may result from exposure to EMFs (see Section 5.4.1.7). The conclusion presented in the GEIS for license renewal (NRC 1996) was that the impacts of EMFs on terrestrial flora and fauna were of small significance at operating nuclear power plants, and these included transmission systems with variable numbers of power lines. Since 1997, over a dozen studies have been published that looked at cancer in animals that were exposed to

EMFs for all of, or most of, their lives. These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2005). Thus, the incremental EMF impact posed by the possible addition of new transmission lines for a new generating facility at any of the alternative sites would be considered minimal.

8.6 Summary of Alternative Site Impacts

Entergy Nuclear selected three sites where Entergy Corporation currently owns and operates nuclear power plants as alternative sites to the proposed Grand Gulf ESP site. The three sites selected for detailed review are:

- River Bend Station, located approximately 39 km (24 mi) northwest of Baton Rouge, Louisiana
- Pilgrim Nuclear Station, located approximately 6 km (4 mi) southeast of Plymouth, Massachusetts
- James A. FitzPatrick Nuclear Power Plant, located approximately 13 km (8 mi) northeast of Oswego, New York.

8.6.1 Summary of Alternative Site Construction Impacts

The staff's characterizations of the environmental impacts of constructing new nuclear generating plants within the scope of the SERI PPE at the three alternatives sites are provided in Table 8-13.

8.6.2 Summary of Alternative Site Operation Impacts

The staff's characterizations of the environmental impacts of operating new nuclear generating plants within the scope of the SERI PPE at the three alternatives sites are provided in Table 8-14.

Table 8-13. Characterization of Construction Impacts at the Alternative Early Site Permit Sites

Impact Category	River Bend	Pilgrim	FitzPatrick
Land use			
Site and vicinity	SMALL	SMALL	SMALL
Power transmission line rights-of-way and offsite areas	SMALL	SMALL to MODERATE	SMALL to MODERATE
Air quality	SMALL	SMALL	SMALL
Water-related			
Water use	SMALL	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL
Ecological			
Terrestrial ecosystems	MODERATE	SMALL	MODERATE to LARGE
Aquatic ecosystems	SMALL	SMALL	SMALL
Threatened and endangered species	SMALL to MODERATE	MODERATE to LARGE	SMALL
Socioeconomic			
Physical	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL
Social and economic	LARGE Beneficial to SMALL Beneficial	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	SMALL to MODERATE[(a)]	MODERATE[(b)]	SMALL to MODERATE[(c)]
Historic and cultural resources	SMALL	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL
Nonradiological health impacts	SMALL	SMALL	SMALL
Radiological health impacts	SMALL	SMALL	SMALL

(a) Most of the adverse impact would be related to effects on transportation.
(b) Most of the adverse impact would be related to effects on transportation and housing.
(c) Most of the adverse impact would be related to effects on transportation near the plant.

Table 8-14. Characterization of Operational Impacts at the Alternative Early Site Permit Sites

Impact Category	River Bend	Pilgrim	FitzPatrick
Land use			
Site and vicinity	SMALL	SMALL	SMALL
Power transmission line rights-of-way and offsite areas	SMALL	SMALL	SMALL
Air quality	SMALL	SMALL	SMALL
Water-related			
Water use	SMALL	SMALL	SMALL
Water quality	SMALL	SMALL	SMALL
Ecological			
Terrestrial ecosystems[(a)]	SMALL	SMALL to MODERATE	SMALL
Aquatic ecosystems	SMALL	SMALL to MODERATE	SMALL
Threatened and endangered species	SMALL	SMALL to MODERATE	SMALL
Socioeconomic			
Physical	SMALL	SMALL to MODERATE	SMALL
Demography	SMALL	SMALL	SMALL
Social and economic	LARGE Beneficial to SMALL Beneficial	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	SMALL to MODERATE	MODERATE[(b)]	SMALL
Historic and cultural resources	SMALL	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL
Nonradiological health impacts[(a)]	SMALL	SMALL	SMALL
Radiological health impacts	SMALL	SMALL	SMALL
Impacts of postulated accidents	SMALL	SMALL	SMALL

(a) Electromagnetic field health effects are indeterminate.
(b) Most of the adverse impact would be related to effects on transportation.

8.7 References

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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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9.0 Comparison of the Impacts of the Proposed and Alternative Sites

The need to compare the proposed Grand Gulf early site permit (ESP) site with alternative sites arises from the requirement in Section 102(2)(C)(iii) of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4332(2)(C)(iii)) that environmental impact statements include an analysis of alternatives to the proposed action. The U.S. Nuclear Regulatory Commission (NRC) criteria to be employed in assessing whether a proposed ESP site is to be rejected in favor of an alternative site is based on whether the alternative site is “obviously superior” to the site proposed by the applicant (*Public Service Co. of New Hampshire* 1977). An alternative site is “obviously superior” to the proposed site if it is “clearly and substantially” superior to the proposed site (*Rochester Gas & Electric Corp.* 1978).

The standard of “obviously superior” “...is designed to guarantee that a proposed site will not be rejected in favor of an alternate unless, on the basis of appropriate study, the Commission can be confident that such action is called for” (New England Coalition on Nuclear Pollution 1978). The “obviously superior” test is appropriate for two reasons. First, the analysis performed by NRC in evaluating alternative ESP sites is necessarily imprecise. Key factors considered in the alternative site analysis, such as population distribution and density, hydrology, air quality, aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics are difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site must necessarily have a wide range of uncertainty. Second, the applicant’s proposed ESP site has been analyzed in detail, with the expectation that most adverse environmental impacts associated with the site have been identified. By design, the alternative sites have not undergone a comparable level of detailed study. For these reasons, a proposed ESP site may not be rejected in favor of an alternative site when the alternative is “marginally better” than the proposed site, but only when it is “obviously superior” (Rochester Gas & Electric Corp. 1978). NEPA does not require that a nuclear plant be constructed on the single best site for environmental purposes. Rather, “...all that NEPA requires is that alternative sites be considered and that the effects on the environment of building the plant at the alternative sites be carefully studied and factored into the ultimate decision” (New England Coalition on Nuclear Pollution 1978).

The NRC staff’s review of alternative sites consists of a two-part sequential test for whether a site is “obviously superior” to the proposed site (NRC 2000). The first part of the test determines whether there are “environmentally preferred”[(a)] sites among the candidate ESP

(a) An “environmentally preferred” alternative site is one for which the environmental impacts are sufficiently less than for the proposed site so that environmental preference for the alternative site can be established (NRC 2000).

sites. The staff considers whether the ESP applicant has (1) reasonably identified alternative sites, (2) evaluated the likely environmental impacts of construction and operation at these sites, and (3) used a logical means of comparing sites that led to the applicant's selection of the proposed site. Based on the NRC staff's independent review, the staff then determines whether any of the alternative sites are environmentally preferable to the applicant's proposed ESP site.

If the staff determines that one or more alternative ESP sites are environmentally preferable, then it would compare the estimated costs (environmental, economic, and time) of constructing the proposed nuclear power plant at the proposed site and at the environmentally preferable site or sites (NRC 2000). To find an obviously superior alternative site, the staff must determine that (1) one or more important aspects, either singly or in combination, of a reasonably available alternative site are obviously superior to the corresponding aspects of the applicant's proposed site, and (2) the alternative site does not have offsetting deficiencies in other important areas.

9.1 Comparison of the Proposed Site with the Alternatives

The staff reviewed the environmental report submitted by System Energy Resources, Inc. (SERI) (SERI 2005) and supporting documentation and conducted site visits at the proposed Grand Gulf ESP site and the three alternative sites. The staff found that SERI had reasonably identified alternative sites, evaluated the environmental impacts of construction and operation, and used a logical means of comparing sites. The following section summarizes the staff's independent assessment of the proposed and alternative sites.

The staff's characterization of the expected environmental impacts of constructing and operating one or more new nuclear unit(s) at the Grand Gulf ESP site and alternative sites within the bounds of SERI's plant parameter envelope are summarized in Tables 9-1 and 9-2. Explanations for the particular characterizations are in Chapters 4 and 5 for the Grand Gulf ESP site, Section 8.5.1 for the River Bend site, Section 8.5.2 for the Pilgrim site, and Section 8.4.3 for the James A. FitzPatrick site. For those impacts to environmental resources for which the staff was unable to reach a single significance level in Chapters 4 and 5 for the Grand Gulf ESP site due to insufficient information, it is necessary to identify the most likely level of impact for the purposes of comparison to alternative sites. In the following analysis, the staff indicated a likely impact level for these unresolved issues based on professional judgement, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a construction permit or combined license is underway. These considerations and assumptions were similarly applied at each of the alternative sites to provide a common basis for comparison. These impact levels are, therefore, best estimates of impacts that the staff used for its "obviously superior" determination. No new data were collected.

Table 9-1. Comparison of the Construction Impacts at the Proposed and Alternative Early Site Permit Sites

Impact Area Category	Grand Gulf	River Bend	Pilgrim	FitzPatrick
Land use	–	–	–	–
Site and vicinity	*Unresolved, likely to be SMALL	SMALL	SMALL	SMALL
Power transmission line rights-of-way and offsite areas	*Unresolved, likely to be SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE
Air quality	SMALL	SMALL	SMALL	SMALL
Water-related	–	–	–	–
Water use	*Unresolved, likely to be SMALL	SMALL	SMALL	SMALL
Water quality	*Unresolved, likely to be SMALL	SMALL	SMALL	SMALL
Ecological	–	–	–	–
Terrestrial ecosystems	*Unresolved, likely to be MODERATE	MODERATE	SMALL	MODERATE to LARGE
Aquatic ecosystems	SMALL	SMALL	SMALL	SMALL
Threatened and endangered species	SMALL	SMALL to MODERATE	MODERATE to LARGE	SMALL
Socioeconomic	–	–	–	–
Physical impacts	SMALL	SMALL	SMALL	SMALL
Demography	LARGE	SMALL	SMALL	SMALL
Social and economic	LARGE Beneficial	LARGE Beneficial to SMALL Beneficial	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	MODERATE	SMALL to MODERATE[(a)]	MODERATE[(b)]	SMALL to MODERATE[(c)]
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Environmental justice	LARGE Beneficial	SMALL	SMALL	SMALL
Nonradiological health	SMALL	SMALL	SMALL	SMALL
Radiological health	SMALL	SMALL	SMALL	SMALL

(a) Most of the adverse impact would be related to effects on transportation.
(b) Most of the adverse impact would be related to effects on transportation and housing.
(c) Most of the adverse impact would be related to effects on transportation near the facility.
* Impact level estimated for the purposes of comparison

Table 9-2. Comparison of the Operational Impacts at the Proposed and Alternative Early Site Permit Sites

Impact Area Category	Grand Gulf	River Bend	Pilgrim	FitzPatrick
Land use	–	–	–	–
Site and vicinity	SMALL	SMALL	SMALL	SMALL
Power transmission line rights-of-way and offsite areas	SMALL	SMALL	SMALL	SMALL
Air quality	SMALL	SMALL	SMALL	SMALL
Water-related	–	–	–	–
Water use	*Unresolved, likely to be SMALL	SMALL	SMALL	SMALL
Water quality	*Unresolved, likely to be SMALL	SMALL	SMALL	SMALL
Ecological	–	–	–	–
Terrestrial ecosystems[(a)]	SMALL	SMALL	SMALL to MODERATE	SMALL
Aquatic ecosystems	SMALL	SMALL	SMALL to MODERATE	SMALL
Threatened and endangered species	SMALL	SMALL	SMALL to MODERATE	SMALL
Socioeconomic	–	–	–	–
Physical impacts	SMALL	SMALL	SMALL to MODERATE	SMALL
Demography	LARGE	SMALL	SMALL	SMALL
Social and economic	LARGE Beneficial	LARGE Beneficial to SMALL Beneficial	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to SMALL Beneficial
Infrastructure and community services	MODERATE	SMALL to MODERATE	MODERATE[(b)]	SMALL
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Environmental justice	LARGE Beneficial	SMALL	SMALL	SMALL
Nonradiological health[(a)]	SMALL	SMALL	SMALL	SMALL
Radiological health	SMALL	SMALL	SMALL	SMALL
Impact of postulated accidents	SMALL for LWR designs; unresolved for gas-cooled reactors	SMALL	SMALL	SMALL

(a) Electromagnetic field health effects are indeterminate.
(b) Most of the adverse impact would be related to effects on transportation and housing.
* Impact level estimated for the purposes of comparison

Some environmental impacts considered for the Grand Gulf ESP site and for the alternative sites are generic for all sites and, therefore, do not influence the comparison of impacts between the Grand Gulf ESP site and the alternative sites. The generic environmental impacts common to all sites are air quality, nonradiological and radiological health impacts, and environmental impacts from postulated accidents and hydrologic alterations. Generic impacts are discussed in Section 8.5.4.

The environmental impact areas shown in Tables 9-1 and 9-2 have been evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – based on the Council on Environmental Quality guidelines and set forth in the footnotes to Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The staff determined the impact level from construction for most of the environmental issues at the sites would be SMALL (see Table 9-1). Construction of transmission corridors for a new ESP facility at the Pilgrim and FitzPatrick sites would have SMALL to MODERATE impacts. For terrestrial ecology and threatened and endangered species, there are factors related to a site that could cause the impact level to increase from SMALL to MODERATE and, in the case of FitzPatrick, to LARGE because of probable impacts to forests and wetlands and associated protected species at that site. In addition, socioeconomic and environmental justice impacts range from SMALL to MODERATE adverse impacts in some aspects, and up to LARGE beneficial impacts in other aspects, such as social and economic benefits because of tax revenue. These are explained more fully in Chapter 4 for the Grand Gulf ESP site and in Chapter 8 for the alternative sites.

Similarly, the staff determined that the impact level from operations for most of the environmental issues at most of the sites would be SMALL (see Table 9-2). Exceptions are aquatic and terrestrial ecosystems and threatened and endangered species at the Pilgrim site, arising from potential impacts on the redbelly turtle. Additionally, social and economic impacts in socioeconomics at the alternative sites include LARGE to SMALL beneficial impacts principally due to added tax revenue and beneficial impacts on the local economy. Impacts at the Grand Gulf ESP site would be LARGE and beneficial. Impacts on infrastructure and community services would be MODERATE adverse at the Grand Gulf ESP site and SMALL to MODERATE adverse at the alternative sites. Environmental justice impacts wold be SMALL at the alternative sites, but up to LARGE and beneficial at the Grand Gulf ESP site. These are explained more fully in Chapter 5 for the Grand Gulf ESP site and in Chapter 8 for the alternative sites.

9.2 Environmentally Preferable Sites

This section discusses whether any of the three alternative sites are environmentally preferable to the Grand Gulf ESP site. As noted in the introduction to this chapter, an "environmentally preferred" alternative site is a site for which the environmental impacts are sufficiently less than for the proposed site such that environmental preference for the alternative site can be established. The issue of environmental preferability is discussed in Section 9.2.1 for construction-related impacts and in Section 9.2.2 for operation-related impacts.

9.2.1 Construction

As shown in Table 9-1, the environmental impacts of construction at the Grand Gulf ESP site are characterized by the staff as SMALL for most impact categories. The exceptions include: demographic impacts, which could be LARGE; the impacts on terrestrial ecosystems and infrastructure and community services, which may involve moderate impacts; and social and economic impacts, which would have LARGE beneficial impacts, largely due to the impact of tax revenue.

At the three alternative ESP sites, the construction-related impacts are also predominately characterized as SMALL. The exceptions are that (1) impacts on terrestrial ecosystems are characterized as MODERATE at the River Bend site, SMALL to MODERATE at the Pilgrim site, and as MODERATE to LARGE at the FitzPatrick site, (2) impacts on threatened and endangered species are characterized as SMALL to MODERATE at the River Bend site, SMALL at the FitzPatrick site, and MODERATE to LARGE at the Pilgrim site, and (3) impacts on infrastructure and community services are characterized as SMALL to MODERATE or MODERATE at the three alternative sites. The economy in the vicinity of the Pilgrim site could also be negatively affected. The Grand Gulf ESP site and three alternative sites would also have various beneficial impacts for the social and economic subcategories of economy and taxes.

While there are some differences in the environmental impacts of construction at the proposed and alternative ESP sites, the staff concludes that none of these differences is sufficient to determine that any of the alternative sites is environmentally preferable to the Grand Gulf ESP site.

9.2.2 Operations

As shown in Table 9-2, the environmental impacts of operations at the Grand Gulf ESP site are characterized by the staff as SMALL for most impact categories. Demographic impacts at the Grand Gulf ESP site could be LARGE. Potential impacts on infrastructure and community services could be MODERATE. Potential social and economic impacts and environmental justice impacts could be LARGE and beneficial, depending in large part on local capture of tax revenues.

At the three alternative ESP sites, the operations-related impacts are also predominately characterized as SMALL. The primary exception is the Pilgrim site, where ecological impacts are characterized as SMALL to MODERATE, and the possibility of a MODERATE adverse impact on local infrastructure and community services and on social and economic components exists. Effects on social and economic components at the River Bend and FitzPatrick sites range from LARGE to SMALL beneficial, based on tax capture.

While there are some differences in the environmental impacts of operation at the proposed and alternative ESP sites, the staff concludes that none of these differences is sufficient to determine that any of the alternative sites is environmentally preferable to the Grand Gulf ESP site.

9.3 Obviously Superior Sites

None of the alternative sites was determined to be environmentally preferable to the Grand Gulf ESP site. Therefore, none of the alternative sites is obviously superior to the Grand Gulf ESP site.

9.4 Comparison with the No-Action Alternative

The no-action alternative refers to a scenario in which NRC denies the ESP request. Denial of the ESP application would prevent early resolution of safety and environmental issues for the site. These issues would have to be addressed during a future licensing action (ESP, construction permit, or combined license), should an applicant decide to pursue construction and operation activities for a nuclear facility at the site at a later time.

In the event that NRC denies the ESP application, SERI could follow any of several paths to satisfy its electric power needs including (1) seeking an ESP construction permit or combined license for a different location, (2) seeking a construction permit or combined license at the same location if the basis for ESP denial was reconciled, (3) purchasing power from other electricity providers, (4) establishing conservation and demand-side management programs,

(5) constructing new generation facilities other than nuclear at the Grand Gulf ESP site, (6) constructing new generation facilities at other locations, (7) delaying retirement of existing Entergy generating facilities, or (8) reactivating previously retired Entergy generating facilities. The preceding paths could be pursued individually or in combination. Each of the paths would have associated environmental impacts.

No significant environmental impacts would be avoided by the no-action alternative because no such impacts are caused by a site-suitability determination.

9.5 References

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10.0 Conclusions and Recommendations

By letter dated October 16, 2003, System Energy Resources, Inc. (SERI), 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 (SERI 2005). The proposed Grand Gulf ESP site is located in Claiborne County, Mississippi, approximately 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. The Grand Gulf ESP site will include one or more nuclear power facilities to be sited adjacent to the existing GGNS Unit 1.

An ESP is a Commission approval of a location for siting for one or more nuclear power facilities, and is separate from the filing of an application for a construction permit (CP) or combined license (COL) for such a facility. An ESP application may refer to a reactor or reactor characteristics or plant parameter envelope, which is a set of postulated design parameters that bound the characteristics of a reactor or reactors that might be built at a selected site. Alternatively, an ESP may refer to a detailed reactor design. The ESP is not a license to build a nuclear power plant; rather, the application for an ESP initiates a process undertaken to assess whether a proposed site is suitable should the applicant decide to pursue a CP or COL.

Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321 et seq.) directs that an environmental impact statement (EIS) be prepared for major Federal actions that significantly affect the quality of the human environment. Subpart A of Title 10 of the Code of Federal Regulations (CFR) Part 52 contains the NRC regulations related to ESPs. The NRC implemented Section 102 of NEPA in 10 CFR Part 51. As set forth in 10 CFR 52.18, the Commission determined that an EIS will be prepared during the review of an application for an ESP. The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for one or more new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such facilities at the site. Under the provisions of 10 CFR 52.21, an ESP is described as a “partial construction permit.” An applicant for a CP or COL for a nuclear power plant or plants to be located at the site for which an ESP was issued can reference the ESP, thus reducing the need to review siting issues at that stage of the licensing process. However, issuance of a CP or COL to construct and operate a nuclear power plant is a major Federal action that requires its own environmental impact statement in accordance with 10 CFR 51.20(b).

Three primary issues—site safety, environmental impacts, and emergency planning—must be addressed in an ESP application. Likewise, in its review of the application, the NRC assesses the applicant's proposal in relation to these issues and determines if the application meets the requirements of the Atomic Energy Act of 1954 and NRC regulations. This EIS addresses the potential environmental impacts resulting from construction and operation of one or more new nuclear units at the proposed and alternative sites.

Upon acceptance of the SERI application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* a Notice of Intent to prepare an EIS and conduct scoping (68 FR 75656). The staff visited the Grand Gulf ESP site on July 29, 2003, January 21, 2004, and April 12 and 13, 2004 to gather information and become familiar with the site and its environs. The staff held a public scoping meeting on January 21, 2004, in Port Gibson, Mississippi to obtain public input on the scope of the environmental review. Subsequent to the site visit and the scoping meeting and in accordance with NEPA and 10 CFR Part 51, the staff evaluated the potential environmental impacts of constructing and operating one or more new nuclear units at the Grand Gulf ESP site.

Included in this EIS are (1) the results of the NRC staff's analyses, which consider and weigh the environmental effects of the proposed action (issuance of the ESP) and of constructing and operating one or more new nuclear units at the ESP site; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of the alternatives; and (4) the staff's recommendation regarding the proposed action based on its environmental review.

During the preparation of this EIS, the staff reviewed the SERI environmental report; consulted with Federal, State, Tribal, and local agencies; and conducted an independent review of the issues following the guidance set forth in NRC's 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*, Environmental Standard Review Plan (NRC 2000). In addition, the NRC considered public comments received during the scoping process and on the draft EIS. These comments and the staff's responses are provided in Appendix D and E of this EIS.

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 draft EIS to allow members of the public to comment on the results of the NRC staff's review. During this comment period, a public meeting was held in Port Gibson, Mississippi on June 28, 2005. 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.

Following the practice the staff used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437) (NRC 1996) and supplemental license renewal EISs, environmental issues are evaluated using the three-level standard of significance – SMALL, MODERATE, or LARGE – developed by NRC using guidelines from the Council on Environmental Quality (40 CFR 1508.27). The footnote to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the following definitions of the three significance levels:

> 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.

Mitigation measures were considered for each environmental issue and are discussed in the appropriate sections. During its environmental review, the staff considered planned activities and actions that SERI indicates it would take should it decide to apply for a CP or COL. Key activities and actions considered by the staff in determining the level of impacts to a resource are discussed throughout the EIS and are listed in Appendix J.

NEPA requires that an EIS include information on:

- Any adverse environmental effects that cannot be avoided should the proposal be implemented
- Any irreversible and irretrievable commitments of resources that would be involved if the proposed action is implemented
- The relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

The NEPA information is provided in Sections 10.1 through 10.3.

10.1 Unavoidable Adverse Environmental Impacts

Section 102(2)(C)(ii) of NEPA (42 USC 4321 *et seq.*) requires that an EIS include information on any adverse environmental effects that cannot be avoided should the proposed action be implemented. Unavoidable adverse environmental impacts are those potential impacts of construction and operation of the proposed new unit(s) that cannot be avoided and for which no practical means of mitigation are available.

If granted, the ESP will not authorize any activities by SERI that would have an environmental impact. This is because SERI did not include a site redress plan in its application as provided by 10 CFR 52.17(c) and 10 CFR 52.25 and thus would not be authorized to perform any of the activities provided by 10 CFR 50.10(e)(1). Consequently, there are no unavoidable adverse environmental impacts associated with implementing the proposed action: granting an ESP to SERI for the Grand Gulf ESP site. However, issuance of an ESP may lead to construction and operation of a new nuclear facility under a CP or COL, either of which would require their own environmental review in accordance with 10 CFR Part 51. Although definitive assessment of adverse environmental impacts from construction and operation of one or more new nuclear units at the Grand Gulf ESP site would be performed at the CP or COL stage for issues that were not resolved, a summary of the impacts based on the analyses presented in this EIS is given below.

10.1.1 Unavoidable Adverse Impacts During Construction

Chapter 4 discusses the impacts from construction in detail. The unavoidable adverse impacts related to construction are listed in Table 10-1 and summarized below. The primary unavoidable adverse environmental impacts during construction would be related to land use. All construction activities for a new nuclear facility, including ground-disturbing activities, would occur within the existing Grand Gulf site boundary. According to SERI, the area that would be affected as a result of permanent facilities is approximately 51 ha (125 ac). Much of this area was previously disturbed during construction of GGNS Unit 1. An additional 111 ha (275 ac) would be disturbed on a short-term basis as a result of temporary activities and facilities and laydown areas (SERI 2005). Additional land may be needed for transmission lines.

Impacts of construction on the terrestrial ecology of the site would be both short-term and long-term. Construction of a new nuclear facility would result in the removal of approximately 59 ha (145 ac) of upland hardwood forest and 43 ha (105 ac) of upland fields, with approximately 17 ha (43 ac) of forested habitat permanently lost. The Grand Gulf ESP site does not contain any old-growth timber, nor any unique or sensitive plants or communities. Therefore, construction activities would not noticeably reduce the local or regional diversity of plants or plant communities. Impacts associated with transmission line upgrades, including right-of-way expansion, are not known at this stage and would have to be evaluated at the CP/COL stage. There are no important animal species or habitats known on the Grand Gulf ESP site. No areas designated by the U.S. Fish and Wildlife Service as critical habitat for threatened or endangered species exist at or near the site; however, a number of terrestrial and aquatic threatened or endangered plants or animals are known to exist in the vicinity of the site, and preconstruction surveys would be required to ensure these species are protected. Loss of upland and lowland forest would be noticeable. Construction would not permanently affect any

Table 10-1. Unavoidable Adverse Environmental Impacts from Construction

Impact Category	Adverse Impacts Based on SERI's Proposal	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Land use	Yes	Comply with requirements of applicable Federal, State, and local permits	51 ha (125 ac) disturbed on a long-term basis; 111 ha (275 ac) additional land disturbed on a temporary basis
Hydrological and water use	Yes	Obtain a Clean Water Act 401 certification prior to site preparation activities; construction would use best management practices	Dewatering systems would depress the water table in the general vicinity, but the impacts would be localized and temporary. Some dredging and shoreline alterations
Ecological			
Terrestrial	Yes	Conduct survey for protected species prior to construction	Loss of wildlife habitat, wetland, and hardwood forest
Aquatic	Yes	Stabilize embankments; install silt fences	Lowered water quality onsite
Socioeconomic	Yes	Implement flexible construction shifts	Potential impacts on housing and educational institutions in Claiborne County
Radiological	Yes	Use as low as reasonably achievable (ALARA) principles	Dose to site preparation and construction workers
Atmospheric and meteorological	Yes	Implement actions to reduce fugitive dust	Equipment emissions and fugitive dust from operation of earth-moving equipment
Environmental justice	Yes	Not applicable - dependent on actions of the State	Dependent upon State tax allocations, adverse socioeconomic impacts could be disproportionate on local minority/low-income community

(a) Additional mitigation measures are presented in Section 4.10. SERI's commitments and the staff's assumptions regarding sources and levels of impact and mitigation are included in Appendix J.

aquatic species, and the possibility of disturbance to the Federally threatened Louisiana black bear is considered to be negligible. Socioeconomic impacts of construction include an increase in traffic and potential strain on housing and educational institutions in Claiborne County.

Atmospheric and meteorological impacts include fugitive dust from construction activities that would be mitigated by dust control plans. Radiological doses to construction workers from GGNS Unit 1 are expected to be well below regulatory limits. Regarding environmental justice, the impacts are dependent on the allocation of tax revenues between the State and Claiborne County.

10.1.2 Unavoidable Adverse Impacts During Operation

Chapter 5 provides a detailed discussion of the impacts from operation. The unavoidable adverse impacts related to operation are listed in Table 10-2 and summarized below. The unavoidable adverse impacts from operation for land use are small. Hydrological, water use, and water-quality impacts during operation are likely to be small resulting from very limited use of Mississippi River flow. Ecological impacts are also small for both ecosystems and threatened and endangered species because of the lack of key habitat at the site. Socioeconomic impacts are primarily increased demand for services in Claiborne County and Port Gibson, along with impacts on infrastructure and community services in this area. Meteorological and radiological impacts are expected to be negligible. Pollutants emitted during operations are considered insignificant.

10.2 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA (42 USC 4321 *et seq.*) requires that an EIS include information on any irreversible and irretrievable commitments of resources that would occur should the proposed action be implemented. There will be no irreversible and irretrievable commitments of resources should the proposed action be implemented. If granted, the ESP will not authorize any activities by SERI that would have an environmental impact. SERI did not include a site redress plan in its application as provided by 10 CFR 52.17(c) and 10 CFR 52.25 and thus would not be authorized to perform any of the activities as provided by 10 CFR 50.10(e)(1). Because the proposed action therefore does not involve commitment of resources, a complete assessment of irreversible and irretrievable commitments of resources would be performed at the CP or COL stage if SERI is granted an ESP and later applies for a CP or COL. This issue is, therefore, not resolved.

Irretrievable commitments of resources during construction of the proposed new unit(s) generally would be similar to that of any major construction project. The actual commitment of construction resources (concrete, steel, and other building materials) would depend on the reactor design selected at the CP or COL stage. Hazardous materials such as asbestos would not be used, if possible. If materials such as asbestos were used, it would be in accordance with safety regulations and practices. The actual estimate of construction materials would be performed at the CP or COL stage when the reactor design is selected.

Table 10-2. Unavoidable Adverse Environmental Impacts from Operation

Impact Category	Adverse Impacts Based on SERI's Proposal	Actions to Mitigate Impacts[a]	Unavoidable Adverse Impacts
Land use	Yes	Follow local land management plans	Upgrade/modification of existing transmission corridors probably needed
Hydrological and water use	Yes	Comply with State discharge permit limits	Use of Mississippi River water
Ecological			
Terrestrial	Yes	Use best management practices	Wildlife collisions with structures
Aquatic	Yes	Use impingement/ entrainment screens for intake; diffuser for thermal discharge	Losses of species in larval state
Socioeconomic	Yes	Implement flexible work hours and road improvements	Potential impacts on housing and educational institutions in Claiborne County; increased traffic
Radiological	Yes	Use as low as is reasonably achievable (ALARA) principles	Dose to workers, the public, and biota
Atmospheric and meteorological	Yes	Comply with State permit limits	Equipment emissions, cooling tower drift and electromagnetic field exposure
Environmental justice	Yes	Not applicable - dependant on actions of the State	Dependent upon State tax allocations, adverse socioeconomic impacts could be disproportionate on local minority/low-income community

(a) Additional mitigation measures are presented in Section 5.11. SERI's commitments and the staff's assumptions regarding sources and levels of impact and mitigation are included in Appendix J.

The staff expects that the use of construction materials in the quantities associated with those expected for the new ESP unit or units, while irretrievable, would be of small consequence, with respect to the availability of such resources.

The main resource that would be irretrievably committed during operation of a new nuclear unit or units would be uranium. The availability of uranium ore and existing stockpiles of highly enriched uranium in the United States and Russia that could be processed into fuel is sufficient, so that the irreversible and irretrievable commitment would be of small consequence.

10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

Section 102(2)(C)(iv) of NEPA (42 USC 4321 *et seq.*) requires that an EIS include information on the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. There will be no short-term use of the environment should the proposed action be implemented because SERI is not authorized to perform any site preparation activities. The evaluation of the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity for the construction and operation of the ESP unit or units can only be performed by discussing the benefits of operating the unit. The benefit is the production of electricity. In accordance with 10 CFR 52.18, an EIS for an ESP does not need to include an assessment of the benefits of the proposed action. However, an assessment of the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity for the construction and operation of one or more new nuclear unit or units would be performed at the CP or COL stage should SERI be granted an ESP and later seek a CP or COL. This issue is, therefore, not resolved.

10.4 Cumulative Impacts

The staff considered the potential cumulative impacts resulting from construction and operation of the proposed unit(s) in the context of past, present, and future actions at the Grand Gulf ESP site in Chapter 7 of this EIS. For each impact area, the staff determined that the potential cumulative impact resulting from construction and operation would be generally SMALL, and further mitigation would not be warranted. The geographical area over which past, present, and future actions could contribute to cumulative impacts is dependent on the type of action considered. Several impact issues were not resolved due to lack of necessary information. These issues have the potential for MODERATE or LARGE adverse impacts and, consequently, cumulative are not resolved and would have to be addressed in a future environmental impact statement, should an applicant for a CP or COL reference an ESP for the Grand Gulf ESP site.

10.5 Staff Conclusions and Recommendations

The staff's recommendation to the Commission related to the environmental impacts of the proposed action is that the ESP should be issued. The staff's evaluation of the safety and emergency preparedness aspects of the proposed action are documented in a separate safety evaluation report prepared in accordance with 10 CFR Part 52 (NRC 2005). This recommendation is based on (1) the environmental report submitted by SERI (2005); (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments received from the public; (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the environmental report and in this EIS; and (6) the staff's conclusion there are no environmentally preferable or obviously superior alternative sites.

A comparative summary showing the staff's estimate of the environmental significance of locating one or more new nuclear units at the Grand Gulf ESP site and at any of the alternative sites is shown in Table 10-3. The estimated environmental significance of the no-action alternative, or denial of the ESP application, is also shown. Table 10-3 shows that the significance of the environmental impacts of the construction and operation of one or more new nuclear units is generally SMALL for all impact categories at all sites, with the exception of certain ecological, socioeconomic, and environmental justice categories. The alternative sites may have environmental effects in at least some categories that reach MODERATE or LARGE significance. The staff concludes that none of the alternative sites assessed are obviously superior to the Grand Gulf ESP site.

The range of impacts estimated by the NRC staff for resolved issues is predicated on certain assumptions; these are identified in each section and in Appendix J. Should the Commission issue an ESP for the Grand Gulf ESP site, the staff will verify that the assumptions identified in Appendix I and Appendix J remain applicable. In addition, certain issues are not considered to be resolved because of a lack of information. A CP or COL applicant referencing an ESP for the Grand Gulf ESP site would need to provide the necessary information for these issues, if the proposed action ultimately would affect the resources associated with these issues.

Table 10-3. Summary of Environmental Significance of Nuclear Power Plant Construction and Operation at the Grand Gulf Early Site Permit Site, at Alternative Sites, and for the No-Action Alternative

	Proposed Action	No-Action Alternative	Alternative Site Options		
Impact Category	**ESP at Grand Gulf**	**Denial of ESP**	**River Bend**	**Pilgrim**	**FitzPatrick**
Land use	Unresolved, likely to be SMALL for construction and SMALL for operation	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE
Ecology	SMALL for operation and Unresolved, likely to be MODERATE for construction	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL to LARGE
Water use and quality	Unresolved, likely to be SMALL	SMALL	SMALL	SMALL	SMALL
Air quality	SMALL	SMALL	SMALL	SMALL	SMALL
Radiological and nonradiological health	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomic	LARGE Beneficial	SMALL	LARGE Beneficial to MODERATE Adverse	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to MODERATE Adverse
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental justice	LARGE Beneficial	SMALL	SMALL	SMALL	SMALL

10.6 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."

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

Atomic Energy Act of 1954. 42 USC 2011, et seq.

National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.

System Energy Resources, Inc. (SERI). 2005. *Grand Gulf Site Early Site Permit Application.* Revision 2, Jackson, Mississippi. Available at http://www.nrc.gov/reading-rm/adams.html, Accession No. ML052780449.

U.S. Nuclear Regulatory Commission (NRC). 1987. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*. NUREG-0800, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volumes 1 and 2, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG-1555, Office of Nuclear Reactor Regulation, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/.

U.S. Nuclear Regulatory Commission (NRC). 2004. *Processing Applications for Early Site Permits*. RS-002, Washington, D.C. Available at http://www.nrc.gov/reactors/new-licensing/esp/esp-public-comments-rs-002.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.

Appendix A

Contributors to the Environmental Impact Statement

Appendix A

Contributors to the Environmental Impact Statement

The overall responsibility for the preparation of this environmental impact statement was assigned to the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. The statement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations and the Pacific Northwest National Laboratory.

Name	Affiliation	Function or Expertise
U.S. Nuclear Regulatory Commission		
James H. Wilson	Nuclear Reactor Regulation	Senior Project Manager
Andrew J. Kugler	Nuclear Reactor Regulation	Branch Chief
Barry Zalcman	Nuclear Reactor Regulation	Technical Monitor
Thomas J. Kenyon	Nuclear Reactor Regulation	Project Management
Cristina Guerrero	Nuclear Reactor Regulation	General Scientist
Jason Fleming	Nuclear Reactor Regulation	General Scientist
Robert Palla	Nuclear Reactor Regulation	Severe Accidents
James Park	Nuclear Materials Safety and Safeguards	Fuel Cycle Impacts
Charles Hinson	Nuclear Reactor Regulation	Health Physics
Steven Klementowicz	Nuclear Reactor Regulation	Radiological Impacts
Jay Lee	Nuclear Reactor Regulation	Design Basis and Severe Accidents
Michael T. Masnik	Nuclear Reactor Regulation	Aquatic and Terrestrial Ecology
Richard L. Emch	Nuclear Reactor Regulation	Radiological Impacts
Mark Notich	Nuclear Reactor Regulation	Historic and Cultural Resources and Non-Radiological Impacts
Amy Snyder	Nuclear Material Safety and Safeguards	Transportation
R. Brad Harvey	Nuclear Reactor Regulation	Peer Review
Charles Hinson	Nuclear Reactor Regulation	Peer Review
Goutam Bagchi	Nuclear Reactor Regulation	Peer Review
John Cook	Nuclear Material Safety and Safeguards	Peer Review
Andrew Balto	Nuclear Materials Safety and Safeguards	Peer Review
Pacific Northwest National Laboratory[(a)]		
Charles A. Brandt		Task Leader
Tara O. Eschbach		Deputy Task Leader
David M. Anderson		Land Use, Related Federal Projects
James M. Becker		Terrestrial Ecology
Amoret L. Bunn		Aquatic Ecology
Philip M. Daling		Transportation

Name	Affiliation	Function or Expertise
Paul L. Hendrickson		Alternatives
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Rebekah H. Krieg		General Scientist
N. Maha Mahasenan		Transportation
James V. (Van) Ramsdell, Jr.		Air Quality, Design Basis and Severe Accidents
Stuart B. Saslow		Water Use, Hydrology, System Design Alternatives
Michael J. Scott		Socioeconomics, Environmental Justice
Darby C. Stapp		Cultural Resources
Amanda Stegen		General Scientist
Dennis L. Strenge		Severe Accidents
Lance W. Vail		Water Use, Hydrology, System Design Alternatives, Geology

(a) Pacific Northwest National Laboratory is operated by Battelle for the U.S. Department of Energy.

Appendix B

Organizations Contacted

Appendix B

Organizations Contacted

During the course of the staff's independent review of potential environmental impacts from siting one or more new nuclear units at Grand Gulf Early Site Permit site, the following Federal, State, Tribal, and local agencies and organizations were contacted:

Advisory Council on Historic Preservation, Washington, D.C.

Alcorn State University, Alcorn State, Mississippi
    Center for Rural Life and Economic Development
    Extension Program

Cape Cod Times (newspaper), Hyannis, Massachusetts

Central New York Regional Planning and Development Board, Oswego, New York

Claiborne County, Port Gibson, Mississippi
    Administrator
    Board of Supervisors - President
    Chancery Clerk
    E 911 Coordinator
    Hospital
    Sheriff's Department - Sheriff
    Tax Assessor/Collector

Clinton Main Street (economic development organization), Clinton, Louisiana

Cornell Cooperative Extension of Oswego County, New York

Department of Health and Human Services - Office of Public Health, Clinton, Louisiana

Fayette, Louisiana
    City Council
    Mayor

East Feliciana Parish, Clinton, Louisiana
West Feliciana Parish, Saint Francisville, Louisiana
    Assessor
    Sheriff's Department

Grand Gulf Military Park, Civil War Battlefield and Museum, Claiborne County, Mississippi

Jefferson County, Fayette, Louisiana
- Board of Supervisors
  - Administrator
  - Purchasing Clerk
  - Receiving Clerk
- Civil Defense
- Chancery Clerk
- Circuit Clerk
- Department of Human Services
- E911 Coordinator
- Economic Development District
- Sheriff
- Supervisor

Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana

Louisiana Division of Archaeology, Baton Rouge, Louisiana

Louisiana State University Agricultural Center Research and Extension, Tensas Parish, Saint Joseph, Louisiana

Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts

Mississippi Department of Archives and History, Jackson, Mississippi

Mississippi Department of Environmental Quality, Jackson, Mississippi

Mississippi Department of Wildlife, Fisheries, and Parks, Jackson, Mississippi

Mississippi Development Authority, Port Gibson, Mississippi

Mississippi Southern Bank - President, Port Gibson, Mississippi

Mississippi State University Extension Services, Fayette, Mississippi

National Association for the Advancement of Colored People - Claiborne County Chapter, Port Gibson, Mississippi

National Marine Fisheries Service
  Northeast Regional Office, Gloucester, Massachusetts
  Southeast Regional Office, Saint Petersburg, Florida

New York Division of Fish, Wildlife and Marine Resources, Albany, New York

NSTAR Electric, Plymouth, Massachusetts

OCO Inc. (Oswego County Opportunity), Fulton, New York

Old County Memorial (newspaper), Plymouth, Massachusetts

Operation Oswego County (economic development organization), Oswego, New York

Oswego County, Oswego, New York
  Department of Planning and Community Development
  Legislative Chairman
  Legislature Clerk
  Sheriff

Oswego Health (integrated health system that includes Oswego Hospital, The Manor at Seneca Hill, Springside at Seneca Hill, the Fulton Health Services Center and other health and residential living facilities), Oswego, New York

Peppercorns, Inc. - Owner (developer), Oswego, New York

Pilgrim Watch (Massachusetts Citizens for Safe Energy), Plymouth, Massachusetts

Pine Hills LLC (real estate development), Plymouth, Massachusetts

Plymouth, Massachusetts
  Director of Planning
  Manager

Plymouth Area Chamber of Commerce, Plymouth, Massachusetts

Plymouth Center Steering Committee/WATD Radio Station, Plymouth, Massachusetts

Plymouth Regional Economic Development Foundation, Inc., Plymouth, Massachusetts

Port Gibson, Mississippi - Mayor

Port Gibson Chamber of Commerce - President and Executive Director, Port Gibson, Mississippi

Port Gibson-Claiborne County Civil Defense - Director, Port Gibson, Mississippi

River Region Health System, Vicksburg, Mississippi

Saint Francisville, Louisiana
- Chief of Police
- Community Development Foundation
- Town Alderman

State University of New York, Oswego, New York

Tribal Nations
- Choctaw Nation of Oklahoma, Durant, Oklahoma
- Mississippi Band of Choctaw Indians, Choctaw, Mississippi
- Tunika Biloxi Indian Tribe of Louisiana, Marksville, Louisiana

U.S. Army Corps of Engineers, Vicksburg District, Vicksburg, Mississippi

U.S. Fish and Wildlife Service
- Louisiana Ecological Services Office, Baton Rouge, Louisiana
- New England Ecological Services Office, Concord, New Hampshire
- New York Ecological Services Office, Cortland, New York

Vicksburg, Mississippi
- Planning Director
- Vicksburg Warren School District

Vicksburg Chamber of Commerce - President, Vicksburg, Mississippi

Vicksburg Warren County Economic Development Foundation, Vicksburg, Mississippi

Warren County, Vicksburg, Mississippi
- Board of Supervisors
- Emergency Management Agency
- Port Commission - President
- Sheriff
- Tax Collectors Office

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 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

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and System Energy Resources, Inc. (SERI), and other correspondence related to the NRC staff's environmental review, under Title 10 of the Code of Federal Regulations (CFR) Part 51, of SERI's application for an early site permit (ESP) at the Grand Gulf ESP site near Port Gibson, Mississippi. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, and are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the Publicly Available Records component of ADAMS. The ADAMS accession numbers or Federal Register citation for each document are included below.

September 30, 2003	Letter from NRC to Ms. Nancy Butler, Harriette Person Memorial Library, regarding maintenance of documents at the public library related to application by SERI for an ESP at the Grand Gulf site. (Accession No. ML032731680)
October 16, 2003	Letter from Entergy to NRC, Early Site Permit Application. (Accession No. ML032960373)
October 22, 2003	Letter from Entergy to NRC, Early Site Permit Application - Reformat and Correction. (Accession No. ML032960315 - package)
November 7, 2003	Letter from NRC to W.A. Eaton, SERI, regarding Notice of Receipt and Availability of Application for an ESP for the Grand Gulf ESP Site. (Accession No. ML033020020 - package)
November 24, 2003	Letter from NRC to W.A. Eaton, SERI, regarding Acceptance of the SERI. Application for an ESP for the Grand Gulf Site. (Accession No. ML033180657 - package)

December 23, 2003	Letter from NRC to SERI forwarding Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Related to Early Site Permit for Grand Gulf. (Accession No. ML033630515)
December 31, 2003	*Federal Register* Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process. (68 FR 75656)
January 6, 2004	Letter from NRC to the National Oceanic and Atmospheric Administration, Fisheries Southeast Regional Office, requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Claiborne County, Mississippi and West Feliciana Parish, Louisiana. (Accession No. ML040081014)
January 6, 2004	Letter from NRC to the Advisory Council on Historic Preservation, regarding analyses of the potential impact to historic and cultural resources to be included in the environmental impact statement related to the application by SERI for an early site permit for the Grand Gulf site. (Accession No. ML040081042)
January 6, 2004	Letter from NRC to New York Ecological Services Office of the U.S. Fish and Wildlife Service, requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Oswego County, New York. (Accession No. ML040081119)
January 6, 2004	Letter from NRC to National Oceanic and Atmospheric Administration Fisheries Northeast Regional Office, requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Oswego County, New York and Plymouth County, Massachusetts. (Accession No. ML040081088)
January 6, 2004	Letter from NRC to New England Ecological Services Office of the U.S. Fish and Wildlife Service, requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Plymouth County, Massachusetts. (Accession No. ML040081108)
January 7, 2004	*Federal Register* Notice of Hearing and Opportunity to Petition for Leave to Intervene - Early Site Permit for the Grand Gulf Site, Docket No. 52-009. (Accession No. ML033430298)

January 7, 2004	Notice of public meeting to discuss the environmental scoping process for the Grand Gulf early site permit review. (Accession No. ML040090364)
January 8, 2004	Letter from NRC to the Mississippi Ecological Services Office of the U.S. Fish and Wildlife Service, requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Claiborne, County, Mississippi. (Accession No. ML040090099)
January 8, 2004	Letter from NRC to the Louisiana Ecological Services Office of the U.S. Fish and Wildlife Service, requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in West Feliciana Parish, Louisiana. (Accession No. ML040090141)
January 8, 2004	Letter from NRC to the Choctaw Nation of Oklahoma inviting participation in the environmental scoping process for the Grand Gulf ESP review. (Accession No. ML040090309)
January 8, 2004	Letter from NRC to the Tunika Biloxi Indian Tribe of Louisiana inviting participation in the environmental scoping process for the Grand Gulf ESP review. (Accession No. ML040090330)
January 8, 2004	Letter from NRC to the Mississippi Band of Choctaw Indians inviting participation in the environmental scoping process for the Grand Gulf ESP review. (Accession No. ML040090292)
January 8, 2004	Letter from NRC to the Mississippi Department of Archives and History regarding inclusion of analyses of the potential impact to historic properties in the environmental impact statement for an ESP at the Grand Gulf site. (Accession No. ML040090125)
January 13, 2004	Letter from NRC to multiple addressees concerning environmental scoping meeting to be held in the Town Hall in Port Gibson, Mississippi on January 21, 2004. (Accession No. ML033530010)
January 21, 2004	Letter from Mississippi Field Office, U.S. Fish and Wildlife Service, responding to NRC letter dated January 8, 2004 and providing list of threatened and endangered species that could be found near the Grand Gulf site. (Accession No. ML040260250)

January 26, 2004	Letter from David A. Stilwell, U.S. Fish and Wildlife Service, New York Field Office, to P.T. Kuo, NRC, responding to NRC letter dated January 6, 2004, requesting a list of threatened and endangered species in the vicinity of the FitzPatrick Nuclear Power Plant, in the Town of Scriba, Oswego County, New York. (Accession No. ML040370323)
January 28, 2004	Letter from Northeast Region, National Oceanic and Atmospheric Administration Fisheries Service, responding to NRC letter dated January 6, 2004, and providing list of threatened and endangered species under National Oceanic and Atmospheric Administration Fisheries jurisdiction in the vicinity of the Grand Gulf site. (Accession No. ML040350504)
January 29, 2004	Letter from NRC to Mayor of Port Gibson, Mississippi, in appreciation of the facility used to host the Grand Gulf ESP environmental scoping meeting on January 21, 2004. (Accession No. ML040330342)
February 5, 2004	Letter from Russell C. Watson, U.S. Fish and Wildlife Service, Louisiana Field Office, to P.T. Kuo, NRC, responding to NRC letter dated January 8, 2004, requesting a list of threatened and endangered species in West Feliciana Parish, Louisiana. (Accession No. ML040500681)
February 9, 2004	Letter from Michael J. Amaral, U.S. Fish and Wildlife Service, New England Field Office, to P.T. Kuo, NRC, regarding the application for an ESP for the Grand Gulf ESP site. (Accession No. ML040650620)
February 18, 2004	Summary of public environmental scoping meeting held on January 21, 2004, in Port Gibson, Mississippi, related to application by SERI for an ESP for the Grand Gulf site. (Accession No. ML040510279, ML040510288 - package)
April 14, 2004	Letter from Mr. Curtis B. James, U.S. Fish and Wildlife Service, Mississippi Field Office, to Dr. Michael T. Masnik, NRC, transmitting information on Federally listed threatened and endangered species as it pertains to the preparation of the environmental impact statement for the ESP for the Grand Gulf site. (Accession No. ML041310449)
May 5, 2004	Summary of site audit to support the environmental review of ESP application for the Grand Gulf site. (Accession No. ML041270478)

May 11, 2004	Issuance of Environmental Scoping Summary Report associated with the staff's review of the application by SERI for an ESP for the Grand Gulf site. (Accession No. ML041330230)
May 19, 2004	Letter from NRC to SERI requesting additional information related to the staff's environmental review of the Grand Gulf ESP application. (Accession No. ML041420530)
May 19, 2004	Follow up to Early Site Permit Application Environmental Audit - Response No. 1. (Accession No. ML041890361)
May 19, 2004	Follow up to Early Site Permit Application Environmental Audit - Response No. 2. (Accession No. ML041470464)
July 1, 2004	Letter from SERI transmitting its response to NRC's staff request for additional information (Letter No. 1). (Accession No. ML050380151)
July 2, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application, Partial Response No. 1. (Accession No. ML050380156)
July 15, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information dated May 19, 2004, related to the staff's environmental review of the Grand Gulf ESP application. (Accession No. ML041610345)
July 19, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP, Partial Response No. 2. (Accession No. ML050380151)
July 22, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application, Partial Response No. 3. (Accession No. ML050380170)

August 10, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application, Partial Response No. 4. (Accession No. ML050380162)
August 16, 2004	Follow up to Early Site Permit Application Environmental Audit - Partial Response 5. (Accession No. ML042400267 - package)
August 16, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application, Letter 2, Partial Response No. 1. (Accession No. ML050380166)
August 26, 2004	Letter from NRC to W.A. Eaton, SERI, regarding supplemental request for additional information related to the staff's environmental review of the Grand Gulf ESP application. (Accession No. ML042390512)
September 30, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application. (Accession No. ML042810132)
October 28, 2004	Letter from NRC to W.A. Eaton, SERI, regarding second supplemental request for additional information related to the staff's environmental review of the Grand Gulf ESP application. (Accession No. ML043020633)
December 10, 2004	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application, Letter No. 5. (Accession No. ML050380174)
January 14, 2005	Letter from PNNL to NRC forwarding information gathered and referenced in the Grand Gulf ESP environmental impact statement. (Accession No. ML050350147)
February 3, 2005	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the staff's environmental review of the Grand Gulf ESP application. (Accession No. ML050380489)
February 7, 2005	E-mail from PNNL to NRC regarding correspondence with U.S. Fish and Wildlife Service for the Grand Gulf ESP application on Louisiana and Mississippi Black Bear. (Accession No. ML050410367)

February 14, 2005	Letter from SERI to NRC transmitting responses to NRC staff's request for additional information regarding the environmental review of the Grand Gulf ESP application. (Accession No. ML050470305)
February 18, 2005	E-mail from PNNL to NRC regarding correspondence with Entergy for the Grand Gulf ESP application on threatened and endangered species at Pilgrim Nuclear Station. (Accession No. ML050550333)
February 23, 2005	E-mail from PNNL to NRC transmitting files containing logs of personal communication made in the process of updating Grand Gulf ESP EIS Chapters 2, 4, and 5 with Federally threatened and endangered species information. (Accession No. ML050600222)
April 21, 2005	Letter from NRC to U.S. Environmental Protection Agency transmitting Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Grand Gulf ESP Site, NUREG-1817. (Accession No. ML051110104)
April 21, 2005	Letter from NRC to SERI forwarding Notice of Availability of the Draft Environmental Impact Statement (DEIS) for an Early Site Permit (ESP) at the Grand Gulf ESP Site. (Accession No. ML051110284)
April 21, 2005	*Federal Register* 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. (70 FR 22155)
May 5, 2005	NRC Press Release No. 05-076, "NRC Seeks Public Input on Grand Gulf Early Site Permit Environmental Impacts; Meeting to be Held June 28." (Accession No. ML051250331)
June 3, 2005	NRC meeting notice announcing public meeting in Port Gibson, Mississippi on June 28, 2005, to discuss the Draft Environmental Impact Statement for the Grand Gulf Early Site Permit Application. (Accession No. ML051560010)
June 24, 2005	Letter from SERI to NRC stating concerns over potential delay in the NRC review of the Grand Gulf Early Site Permit Application. (Accession No. ML051950260)
July 14, 2005	Letter from SERI to NRC in regards to Draft Environmental Impact Statement (DEIS) for an Early Site Permit (ESP) at the Grand Gulf ESP Site. (Accession No. ML052000275)

July 14, 2005	Letter from U.S. Environmental Protection Agency (EPA) to NRC providing comments on EPA's review of NUREG-1817 Draft Environmental Impact Statement Early Site Permit (ESP) at the Grand Gulf ESP Site. (Accession No. ML052090157)
August 11, 2005	Summary of Public Meeting to Receive Comments on Draft NUREG-1817, Draft Environmental Impact Statement for the Grand Gulf Early Site Permit Application. (Accession No. ML0582280160)
August 16, 2005	NRC Press Release No. 05-111, "NRC Revises Schedule for Reviewing Existing Early Site Permit Applications." (Accession No. ML052280400)
September 3, 2005	Letter from SERI to NRC transmitting response to request for comments on USGS Deaggregation Approach. (Accession No. ML052510432)
September 3, 2005	Letter from SERI to NRC transmitting response to request for additional information regarding the Grand Gulf Early Site Permit. (Accession No. ML052510434)
October 3, 2005	Letter from SERI to NRC, transmitting the Early Site Permit Application, Revision 2. (Accession No. ML052780449)
November 4, 2005	Letter from SERI to NRC transmitting response to request for additional information regarding Grand Gulf Early Site Permit Application. (Accession No. ML060190548)
January 23, 2006	Letter from SERI to NRC transmitting response to request for additional information regarding the Grand Gulf Early Site Permit Draft Environmental Impact Statement. (TAC MC 1379)
March 2, 2006	Letter from SERI to NRC committing to including cultural resource-specific directions in its Excavation and Backfill Work Procedures for construction activities. (Accession No. ML060650273)

Appendix D

Scoping Meeting Comments and Responses

Appendix D

Scoping Meeting Comments and Responses

On December 31, 2003, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (68 FR 75656) to notify the public of the staff's intent to prepare an environmental impact statement (EIS) to support the early site permit (ESP) application of System Energy Resources, Inc. for the proposed Grand Gulf ESP site. This EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality guidelines, and Title 10 of the Code of Federal Regulations (CFR) Parts 51 and 52. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* notice. The NRC also invited the applicant; Federal, Tribal, State, and local government agencies; local organizations; and individuals to participate in the scoping process by providing oral comments at a scheduled public meeting and/or submitting written suggestions and comments no later than February 12, 2004.

The scoping process included a public meeting, which was held at the Port Gibson City Hall in Port Gibson, Mississippi, on January 21, 2004. The NRC announced the meeting in local newspapers (*The Clarion-Ledger* and the *Port Gibson Reveille*), issued press releases, and distributed flyers locally. Approximately 68 members of the public attended the meeting. This session began with NRC staff members providing a brief overview of the ESP process and the NEPA process. Following the NRC's prepared statements, the meeting was opened for public comments. Eighteen (18) attendees provided either oral comments or written statements that were recorded and transcribed by a certified court reporter. The transcript of the meeting can be found as an attachment to the meeting summary, which was issued on February 18, 2004. Additional comments received after the meeting are also available. The meeting summary is available for public inspection by local residents at the Harriette Person Memorial Library. The meeting summary is also available in the NRC Public Document Room or electronically from the Publicly Available Records (PARS) component of NRC's document system, the Agencywide Document Access and Management System (ADAMS) under accession number ML040510288. ADAMS is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room). Note that the URL is case-sensitive.

The scoping process provides an opportunity for public participants to identify issues to be addressed in the EIS and highlight public concerns and issues. The Notice of Intent identified the following objectives of the scoping process:

- Define the proposed action which is to be the subject of the EIS

- Determine the scope of the EIS and identify significant issues to be analyzed in depth

- Identify and eliminate from detailed study those issues that are peripheral or that are not significant

- Identify any environmental assessments and other EISs that are being prepared or will be prepared that are related to but not part of the scope of the EIS being considered

- Identify other environmental review and consultation requirements related to the proposed action

- Indicate the relationship between the timing of the preparation of the environmental analyses and the Commission's tentative planning and decision making schedule

- Identify any cooperating agencies and, as appropriate, allocate assignments for preparation and schedules for completing the EIS to the NRC and any cooperating agencies

- Describe how the EIS will be prepared and include any contractor assistance to be used.

At the conclusion of the scoping period, the NRC staff and its contractor reviewed the transcripts and all written material received and identified individual comments. Forty-seven (47) e-mails containing comments were also received during the scoping period. All comments and suggestions received orally during the scoping meeting or in writing were considered. Each set of comments from a given commenter was given a unique alpha identifier (commenter ID letter), allowing each set of comments from a commenter to be traced back to the transcript, letter, or e-mail in which the comments were submitted.

Preparation of the EIS will take into account all the relevant issues raised during the scoping process. The EIS will be made available for public comment. The comment period for the EIS will offer the next opportunity for the applicant; interested Federal, Tribal, State, and local government agencies; local organizations; and members of the public to provide input to the NRC's environmental review process. The comments received on the draft EIS will be considered in the preparation of the final EIS. The final EIS, along with the staff's Safety Evaluation Report, will provide much of the basis for the NRC's decision on whether to grant System Energy Resources, Inc. an ESP.

Each comment applicable to this environmental review is summarized in this appendix. This information, which was extracted from the *Grand Gulf Scoping Summary Report*, is provided for convenience of those interested in the scoping comments applicable to this environmental review. The comments that are outside the scope of the environmental review for the proposed Grand Gulf ESP site are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the summary report. The ADAMS accession number for the summary report is ML040510288. This accession number is provided to facilitate access to the document through the Public Electronic Reading Room (ADAMS) at http://www.nrc.gov/reading-rm.html.

Table D-1 identifies individuals who provided comments and the Commenter ID number associated with each person's set(s) of comments. The individuals are listed in the order in which they spoke at the public meeting and in alphabetical order for the comments received by letter or e-mail.

Table D-1. Individuals Providing Comments During Scoping Comment Period

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
A	George A. Williams	Entergy	Public Meeting Transcript (ML040360176)
B	Curtis James	U.S. Fish and Wildlife Service	Public Meeting Transcript (ML040360176)
C	Landon Huey	Concerned Citizen	Public Meeting Transcript (ML040360176)
D	Paul Gunter	Nuclear Information Resource Service	Public Meeting Transcript (ML040360176)
E	A. C. Garner	Claiborne County Chapter, National Association for the Advancement of Colored People	Public Meeting Transcript (ML040360176)
F	Soloman Wilson	Concerned Citizen	Public Meeting Transcript (ML040360176)
G	Rose Johnson	Mississippi Chapter Sierra Club	Public Meeting Transcript (ML040360176)
H	Evan Doss, Jr.	Concerned Citizen	Public Meeting Transcript (ML040360176)
I	Nathalie Walker	Advocates for Environmental Human Rights	Public Meeting Transcript (ML040360176)
J	Alexander Martin	Concerned Citizen	Public Meeting Transcript (ML040360176)
K	Becky Gillette	Mississippi Chapter Sierra Club	Public Meeting Transcript (ML040360176)

Table D-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
L	Martha Ferris	Concerned Citizen	Public Meeting Transcript (ML040360176)
M	J. Scott Peterson	Nuclear Energy Institute	Public Meeting Transcript (ML040360176)
N	Phil Segrest	Concerned Citizen	Public Meeting Transcript (ML040360176)
O	Monique Harden	Advocates for Environmental Human Rights	Public Meeting Transcript (ML040360176)
P	Jerry Landrum	Concerned Citizen	Public Meeting Transcript (ML040360176)
Q	Ruth Pullen	Concerned Citizen	Public Meeting Transcript (ML040360176)
R	David Ritter	Public Citizen/Critical Mass	Public Meeting Transcript (ML040360176)
S	Claiborne County Chapter, NAACP	Concerned Citizen	Attachment to Transcript (ML040360176)
T	J. Scott Peterson	Nuclear Energy Institute	Attachment to Transcript (ML040360176)
U	Cheryl Catranbone	Concerned Citizen	E-Mail (ML040540768)
V	Barbara Powell	Concerned Citizen	E-Mail (ML040540776)
W	Edward A. Mainland	Concerned Citizen	E-Mail (ML040540774)
X	Ned Ford	Concerned Citizen	E-Mail (ML040540772)
Y	Gilbert Woolley	Concerned Citizen	E-Mail (ML040540766)
Z	Reilly Morse	Concerned Citizen	E-Mail (ML040540765)
AA	Lorraine Kitman	Concerned Citizen	E-Mail (ML040540755)
AB	Jane W. Lusk	Concerned Citizen	E-Mail (ML040540857)
AC	Tony Bland	Concerned Citizen	E-Mail (ML040540758)
AD	Cynthia Sarthou	Gulf Restoration Network	E-Mail (ML040540753)
AE	Mark M. Gonzalez	Concerned Citizen	E-Mail (ML040540787)

Table D-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
AF	Julianna Padgett	Concerned Citizen	E-Mail (ML040540783)
AG	Micah Walker Parkin	Alliance for Affordable Energy	E-Mail (ML040540795)
AH	Wendy King	Concerned Citizen	E-Mail (ML040540793)
AI	Leonard Levine	Concerned Citizen	E-Mail (ML040540791)
AJ	Paula Vassey	Concerned Citizen	E-Mail (ML040540797)
AK	Videojan	Concerned Citizen	E-Mail (ML040540799)
AL	Paul Gunter	Nuclear Information and Resource Service	E-Mail (ML040540801)
AM	Ruth Pullen	Concerned Citizen	E-Mail (ML040540802)
AN	Chris Holly	Concerned Citizen	E-Mail (ML040540812)
AO	Tom Pullen	Concerned Citizen	E-Mail (ML040540805)
AP	Tiffany Elyce Crane	Concerned Citizen	E-Mail (ML040540821)
AQ	Charlie Brenner	Concerned Citizen	E-Mail (ML040540826)
AR	Susan Hall	Concerned Citizen	E-Mail (ML040540827)
AS	Marianne Hill	Concerned Citizen	E-Mail (ML040540829)
AT	Ginnette Lolli	Concerned Citizen	E-Mail (ML040540831)
AU	Betty Daugherty	Concerned Citizen	E-Mail (ML040540834)
AV	Tom Mann	Concerned Citizen	E-Mail (ML040540836)
AW	Alex Major	Concerned Citizen	E-Mail (ML040540839)
AX	K. Brad Ott	Concerned Citizen	E-Mail (ML040540843)
AZ	J. Scott Peterson	Nuclear Energy Institute	E-Mail (ML040540761)
BA	Solomon S. Wilson	Claiborne County Hospital	E-Mail (ML040780554)
BB	Patricia Neveleff	Concerned Citizen	E-Mail (ML040540780)
BC	Davis Mounger	Concerned Citizen	E-Mail (ML040540782)
BD	Martha Ferris	Concerned Citizen	E-Mail (ML040540786)

Table D-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
BE	William Ferris	Concerned Citizen	E-Mail (ML040540792)
BF	Takasha Lewis	Concerned Citizen	E-Mail (ML040540798)
BG	Michael Berk	Mississippi State University	E-Mail (ML040540751)
BH	Bob Kochtitzky	Mississippi 2020 Network	E-Mail (ML040540752)
BI	Sallie E. Davis	Concerned Citizen	E-Mail (ML040540760)
BJ	Becky Gillette	Mississippi Chapter Sierra Club	E-Mail (ML040540764)
BK	Judy Treichel	Concerned Citizen	E-Mail (ML040540769)
BL	Arthur D. Unger	Concerned Citizen	E-Mail (ML040540773)
BM	Christine Blair	Concerned Citizen	E-Mail (ML040540799)
BN	Lavaree Jones	Concerned Citizen	E-Mail (ML040540845)
BO	Christine Murphey	Concerned Citizen	E-Mail (ML040540853)
BP	Katherine B. Senter	Concerned Citizen	E-Mail (ML040540861)

The comments that are considered in the evaluation of the environmental impact in this EIS are summarized in the following pages. To review all the comments received during scoping, refer to the meeting summary (Accession No. ML040510288). For those comments that do not just provide general information, the responses provide the appropriate section in the EIS where the subject has been addressed. Parenthetical numbers after each comment refer to the commenter's ID letter and the comment number. Comments can be tracked to the commenter and the source document through the ID letter and comment number listed in Table D-1.

Comments are grouped by the following categories:

D.1 Comments Concerning Air Quality
D.2 Comments Concerning Surface Water Use and Quality
D.3 Comments Concerning Aquatic Ecology
D.4 Comments Concerning Threatened or Endangered Species
D.5 Comments Concerning Socioeconomics
D.6 Comments Concerning Environmental Justice
D.7 Comments Concerning Radiological Impacts
D.8 Comments Concerning Uranium Fuel Cycle and Waste Management
D.9 Comments Concerning Decommissioning
D.10 Comments Concerning Cumulative Impacts

D.1 Air Quality

Comment: Nuclear power is clean, and it is emission-free. You can easily get a lot of large generation with one unit. (A-4)

Comment: Today, nuclear energy provides electricity to power one out of every five U.S. homes and businesses. It is the only large-scale, emission-free electricity source that can be readily expanded. Nuclear power plants do not produce sulfur dioxide, nitrogen oxides or the major greenhouse gas, carbon dioxide. I can see every day that we will need more electricity – and we will also need clean air. With nuclear energy, we can have both. Entergy's Grand Gulf Station generates about one-fifth of this state's power. In 2002, operation of Grand Gulf avoided the emission of nearly 50,000 tons of sulfur dioxide and more than 20,000 tons of nitrogen oxide to the state's atmosphere, compared to what would have been emitted by fossil electric generating plants. (T-4)

Comment: Today, nuclear energy provides electricity to power one out of every five U.S. homes and businesses. It is the only large-scale, emission-free electricity source that can be readily expanded. Nuclear power plants do not produce sulfur dioxide, nitrogen oxides or the major greenhouse gas, carbon dioxide. (AZ-4)

Response: *The impacts on air quality resulting from construction and operation of proposed units at Grand Gulf are discussed in Chapters 4 and 5 of the environmental impact statement.*

D.2 Surface Water Use and Quality

Comment: The impacts on the Mississippi River arising from any increased intake of cooling water for the operation of any new proposed nuclear power units should be included. Now, Grand Gulf right now operates on a cooling tower, and that does provide some reduced impact on the Mississippi as it were – and like most other units draw directly from the water source, and they discharge directly into the water source. But we don't know for a fact that this new design won't in fact use a once-through cooling system, which might be taking in as much as 2-1/2 billion gallons of water a day out of the Mississippi River. And because we are not being provided with a specific design, we don't really know what the water intake is. So in fact again all the potential impacts on the Mississippi River arising from that need to be incorporated into this environmental impact statement. Also, all the impacts associated with the possibility of flooding of the Mississippi River on the safe operation of this proposed facility, as well as the existing facility, but clearly we have seen indications that the flooding and the river itself can change. So clearly an environmental impact statement needs to take into account and closely study how changes in the Mississippi River might affect future operation. (D-5)

Response: *The impact from any cooling system using the parameters identified in the plant parameter envelope (PPE) have been be reviewed in accordance with the environmental standard review plan (NUREG-1555) and discussed in the EIS in Sections 4.3 and 5.3. At this time, the applicant has indicated that a closed cooling system employing a cooling tower will be used and not a once-through cooling system. Therefore, the early site permit will not consider once-through cooling. If the applicant were subsequently to decide that they were interested in once-through designs it would require a new application. The particular cooling system ultimately chosen by the applicant will have to fall within the PPE submitted by the applicant. The impact associated with the possibility of flooding of the Mississippi River on the safe operation of the existing facility is outside the scope of this EIS. The impact associated with the possibility of flooding of the Mississippi River on the safe operation of this proposed facility was reviewed as part of the Site Safety Analysis Report per 10 CFR 52.17 and the NRC's Office of Nuclear Reactor Regulation Review Standard RS-002 Section 2.4, and is presented in the Safety Evaluation Report Section 2.4. This comment is outside the scope of this EIS.*

Comment: The EIS for the Grand Gulf nuclear power station is therefore required to address all of the following. All impacts on the Mississippi River arising from any increased intake of reactor cooling water for the operation of any proposed new nuclear power units. (AL-1)

Response: *Impact on the Mississippi River arising from any increased intake of reactor cooling water for the operation of any proposed new nuclear power units was reviewed in accordance with the environmental standard review plan (NUREG-1555, Section 5.2) and discussed in the EIS in Sections 4.3 and 5.3.*

Comment: The EIS for the Grand Gulf nuclear power station is therefore required to address all of the following. All impacts on the Mississippi River arising from the increase in the routine discharge of chemicals, heavy metals, cleaning solvents, biocides and radioactive isotopes into the Mississippi River arising from the operation of additional nuclear power units. (AL-4) (D-8)

Response: *Impact on the Mississippi River arising from the increase in the routine discharge of chemicals, heavy metals, cleaning solvents, and biocides into the Mississippi River arising from the operation of additional nuclear power units was reviewed in accordance with the environmental standard review plan (NUREG-1555, Section 5.2) and discussed in the EIS in Sections 4.3 and 5.3. Impact on the Mississippi River arising from the radioactive isotopes released into the Mississippi River from the operation of additional nuclear power units was reviewed in accordance with the environmental standard review plan (NUREG-1555) and discussed in the EIS in Sections 4.3 and 5.3.*

D.3 Aquatic Ecology

Comment: Well, wetlands, and I don't even know if wetlands, since it is on this site, would even be involved, but that would be a concern to the Fish and Wildlife Service. (B-1)

Comment: All impacts on the aquatic environment of the Mississippi River arising out of any increase in thermal discharge into the river from cooling water need to be addressed from these additional units. (D-6)

Comment: All impacts on the Mississippi River arising from the increased impingement and entrainment, or the sucking in and pinning of fish or fish spawn, or other aquatic life and nutrients arising out of increased reactor cooling water intake. (D-7)

Comment: When I was a child, I would go to that creek and I would kick over rocks, and I would walk it, and I would fish out of it. So when I got back, I went to the creek again. And I went down and I picked up a rock. Now, years ago when I picked up a nice-sized rock, I would find nice little crawly things under it. Sometimes just little crawling things under it. But when I came back this time, I picked up a rock, and I looked, and there was nothing there. And then I thought that nuclear power plant. (F-1)

Comment: I would like to emphasize the need to truly look at all those things, and then as you do the impact study, to make sure that we are informed in a very meaningful way on whether or not when I catch a fish over there in Louisiana that has a funny look on it, and got a little growth on it, I think nuclear power plant, and I need to know that it is not. (F-3)

Comment: All impacts on the aquatic environment of Mississippi River arising from any increase in thermal discharge of reactor cooling water as result of the operation of additional nuclear power units. (AL-2)

Comment: All impacts on Mississippi River arising from the increased impingement and entrainment of fish, fish spawn, other aquatic life and nutrients arising from the increased reactor cooling water intake for any proposed additional nuclear power units. (AL-3)

Comment: All impacts on the Mississippi River arising from any increased intake of reactor cooling water for the operation of any proposed new nuclear power units. (AL-20)

Response: *The impacts on aquatic ecology resulting from construction and operation of proposed units at Grand Gulf are discussed in Chapters 4 and 5 of the EIS.*

D.4 Threatened or Endangered Species

Comment: Federally-listed species, and those would include the endangered Interior least tern, the endangered pallid sturgeon found in the lower Mississippi River. The threatened Bayou darter, and I am not saying – I am saying that these would be species that we would be concerned with and inform the NRC. The threatened bald eagle, and the Federally-listed threatened Louisiana black bears. Particularly secondary impacts to threatened and endangered species. (B-2)

Response: *The U.S. Nuclear Regulatory Commission (NRC) consulted with the U.S. Fish and Wildlife Service (FWS) to request a list of Federal threatened, endangered, proposed, and candidate species that are known to occur, or that potentially could occur, on the Grand Gulf site or in the vicinity (and on or in the vicinity of the alternate sites) and that could thus be impacted by activities that are the subject of the EIS for the Grand Gulf early site permit. The NRC also requested from FWS a statement of concerns regarding such species. NRC evaluated impacts, both direct and indirect, to such species in consideration of the concerns expressed by the FWS. NRC presented these results in Chapters 4 and 5 of the EIS.*

D.5 Socioeconomics

Comment: Shame on you, [Entergy], trying to hold the Claiborne County residents hostage because of job shortages. (G-6)

Comment: But back to the tax issue. The money was divvied up by the Legislature to the other counties, and their rationale was that the people from the other counties were paying an electric bill that came from Grand Gulf, and therefore they ought to benefit some back from it. Well, I think that we ought to take that same thing and I think we ought to challenge our political leaders in the county here, and in the city, to go back to the Legislature and say our people go to the gaming facilities in Vicksburg, and we want our share of that money. (N-2)

Comment: We have talked about the poverty level, and the poverty level here is because we don't have enough industry, and that's why I say can anybody really say that we have not all benefitted from what Grand Gulf has brought to this county. I would hate to think where we are now or where we would be now if we had not had the benefits from Grand Gulf. So we need to address education and how our money is being spent, more than how much more money we need, although I do agree that we need more. (N-8)

Response: *The basis of these comments is not clear. Existing socioeconomic conditions, including tax payments, are covered in Chapter 2 of the EIS and the potential impact of new plants in Chapters 4 and 5.*

Comment: Due to a lack of adequate distribution of local tax revenue from the plant, local government and emergency services are prevented from being fully prepared to protect the public health and safety and provide an adequate emergency plan. (S-12)

Comment: One major concern is inadequate emergency planning and infrastructure in Claiborne County and beyond. Due to the Mississippi Legislature's decision to take away $200 million in tax revenues generated from Grand Gulf and give them to other counties in the state, Claiborne County's emergency planning infrastructure is woefully underfunded to deal with the present nuclear plant – let alone a new plant. There is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. There are significant impediments to emergency planning to safeguard area residents in case of an accident or act of terrorism at the facility. (U-7)

Comment: One major concern is inadequate emergency planning and infrastructure in Claiborne County and beyond. Due to the Mississippi Legislature's decision to take away $200 million in tax revenues generated from Grand Gulf and give them to other counties in the state, Claiborne County's emergency planning infrastructure is woefully underfunded to deal with the present nuclear plant-let alone a new plant. There is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. (X-12) (AE-8) (BE-8) (BF-8) (BH-8) (BJ-9)

Comment: Another important concern is inadequate emergency planning and infrastructure in Claiborne County and beyond. Claiborne County's emergency planning infrastructure is woefully underfunded to deal with the present nuclear plant – let alone a new plant, because the Mississippi Legislature took away $200 million in tax revenues generated from Grand Gulf and give it to other counties in the state. There is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. (Z-6)

Comment: Not unlike other nuclear power plant sites, a major concern is inadequate emergency planning and infrastructure. Specifically though, due to the Mississippi Legislature's decision to take away $200 million in tax revenues generated from Grand Gulf from Claiborne County and give them to other counties in the state, Claiborne County's emergency planning infrastructure is woefully underfunded to deal with the present nuclear plant – let alone a new plant. There is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. Obviously, there are significant impediments to emergency planning to safeguard area residents in case of an accident or act of terrorism at the facility. (AA-7)

Comment: Moreover, Claiborne County's emergency planning infrastructure is woefully under funded and could not adequately deal with any incident at the present nuclear plant – let alone a new plant. Sadly, existing emergency planning and infrastructure in Claiborne County and beyond are simply inadequate to address a potential incident. (AD-8)

Comment: There has been little emergency planning to safeguard area residents and there does not appear to be resources for emergency planning for a new plant, in case of an accident or act of terrorism at the facility. (AF-10)

Comment: Another major concern is inadequate emergency planning and infrastructure in Claiborne County and beyond. Money that should be available for this planning, has been distributed to other counties in Mississippi. This has left Claiborne County's emergency planning infrastructure extremely underfunded to deal with the present nuclear plant and unable to add a new plant. If we look at all the related services, it can be seen that there is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. Unfortunately, the emergency plan relies heavily on teachers to shelter and evacuate school children, even though the teachers may not have obtained consent from parents and guardians. This heavy burden should not be born just by the teachers. There needs to be a coordinated system of emergency services. (AF-11)

Comment: Another major concern is information we have received regarding inadequate emergency planning and infrastructure in Claiborne County. The Mississippi Legislature's decision to take away $200 million in tax revenues generated from Grand Gulf and give them to other counties in the state has crippled Claiborne County's emergency planning infrastructure leaving it underfunded and unprepared to deal with the present nuclear plant, much less a new plant. It has been brought to our attention that there is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department, there is only one fire station in the rural county, the hospital in Port Gibson is not open 24 hours per day, and the radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. This is far from the ideal scenario should the worst occur. (AG-7)

Comment: One of my major concerns about your permitting this nuclear power plant is inadequate emergency planning and infrastructure in Claiborne County and beyond. Due to the

Mississippi Legislature's decision to take away $200 million in tax revenues generated from Grand Gulf and give them to other counties in the state, Claiborne County's emergency planning infrastructure is woefully underfunded to deal with the present nuclear plant, let alone a new plant. There is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. (AH-8)

Comment: One primary concern is inadequate emergency planning and infrastructure in Claiborne County and beyond. Due to the Mississippi Legislature's decision to take away $200 million in tax revenues generated from Grand Gulf and give them to other counties in the state, Claiborne County's emergency planning infrastructure is woefully underfunded to deal with the present nuclear plant – let alone a new plant. There is not enough money to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24/7. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. (AI-8)

Comment: I am also concerned about the inadequate emergency planning and infrastructure in Claiborne County and beyond. Claiborne County's emergency planning infrastructure is too under-funded to deal with the present nuclear plant – let alone a new plant. There is not adequate money available to fund the Sheriff's Department, Civil Defense or the Fire Department. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. (AM-8) (AQ-8) (AS-11) (AW-9) (BN-10)

Comment: I am also concerned about the inadequate emergency planning and infrastructure in Claiborne County and beyond. Claiborne County's emergency planning infrastructure is too under-funded to deal with the present nuclear plant – let alone a new plant. (AO-7)

Comment: Another major concern is that of inadequate emergency planning and infrastructure in Claiborne County and beyond. Claiborne County's emergency planning infrastructure is woefully under funded and currently, the county cannot even support the present nuclear plant, let alone a new facility. There is only one fire station in the rural county, and the hospital in Port Gibson is not open 24 hours per day. The radiological emergency plan relies heavily on teachers to shelter and evacuate school children without obtaining adequately informed consent or any statutory authority. There are significant impediments to emergency planning, thus providing no safeguard to area residents in case of an accident or act of terrorism. (AP-8)

Comment: I am also concerned for security reasons since the infra structure in Claiborne County is under funded and not developed. (AU-4)

Comment: New Orleans has no evacuation plan for hurricanes. What's the point? There's no way out! If the area can't handle mother nature, how are we suddenly going to become savvy in emergency planning and infrastructure compensation in case of a nuclear power plant breakdown? Claiborne County in Mississippi, the site of the plant, lost $200 million in tax revenues generated from Grand Gulf due to a state legislative redistribution. The County is underfunded to deal with the present nuclear plant-let alone a new plant. There is only one fire station in the county! Not only is the proposal life-threatening to the community, it is socially irresponsible as well. (BO-6)

Response: *The economic consequences of implementing the emergency preparedness plan from proposed construction and operation of the Grand Gulf units are addressed in Chapters 4 and 5 of the EIS.*

Comment: All impacts on public health and safety arising out of a severe accident, including the impacts of the accident itself, sheltering, evacuation, radiation exposure, treatment, and reoccupation, or relocation of populations, entire communities, and as we have seen in the accident that happened at the [Chernobyl] Power Station. (D-11)

Comment: Claiborne County was receiving all of the tax monies that came to this county. Well, sometime during that particular period, it was decided that the monies needed to be redistributed, okay? And what happened was that Claiborne County ended up receiving just a small portion, and the rest of it was distributed to other counties. (E-2)

Comment: With respect to the tax revenues generated by the facility, and you have heard a little bit about that already tonight, and I understand that could be a huge issue. And if you are getting huge tax benefits and you want to take the attendant risks, I am not here to judge you. But that is not the situation that you are in. Claiborne County receives a very small portion of the tax revenues generated by the facility. That was not true at first, but soon after the facility began operating, it all changed. So that there are now 48 counties that share the tax revenues generated by the facility. The facility is not in 48 counties, It is in this county, and since that change happened, we are basically talking about somewhere in the neighborhood of $200 million that should have come to this county. (I-3)

Comment: One cost that you have to look at is the Gulf of Mexico. If there is an accident at this plant, and it goes down the Mississippi River, you will destroy the seafood industry that now creates hundreds of millions of dollars in revenue and food for people to eat. (K-4)

Comment: There are tax benefits here even though the tax money, a large portion of it, was taken away from the county, and I think that Mr. Doss, who was a tax collector here and assessor for a number of years, could attest to this. (N-7)

Comment: And I guess the main thing that I wanted to talk about that some people have kind of referred to, but I would like to go into a little more detail, is the issue of the contamination of the Mississippi River in the case of catastrophic accident or a high release of nuclear waste. I think Becky addressed the issue of the fisheries, but if this river was contaminated many of the communities the length of the river from here down depends on the river for water, and there is an industrial corridor from Baton Rouge to New Orleans that depends on the river water for all their industrial usage. New Orleans itself depends on the river for drinking water, and there is also the issue of wetlands, which have been used for water purification and hurricane mitigation. There is the fisheries, and also the current could potentially carry this waste from Florida to Texas. So you are talking about just incomprehensible damage if this whole area was contaminated, and I think that is something that really needs to be considered. (Q-2)

Comment: Benefits to this area briefly with 11 percent unemployment for Claiborne County, and I guess within the last decade or so there has been a loss of population to the county, this is not typically interpreted as something as signs of a prosperous area when you are losing population, and you have unemployment rates like that. (R-10)

Comment: The deeper one digs into the past and present practices of the nuclear industry, the less supportable it becomes. I understand this plant is to be sited in a community with little economic resources, and there will probably be promised of riches to be had in the form of property tax relief, or new schools and hospitals, or the other similar bribes that have been offered to similar communities in the past. Well, in Ohio, we cannot point to a single person who has died from radioactive exposure from the nuclear plants here. However, as much of the State has experienced the loss of billions of dollars in the form of disproportionate rate increases for a modest amount of power, it is inevitable that thousands of lives have been lost and will be lost because of the degradation of public services, personal and corporate wealth and the other impacts of draining a few percentage points of the entire local economy have accrued. (X-9)

Comment: All potential socio-economic impacts from the elevated national security requirements and countermeasures to protect a larger target of terrorism with the expansion of the nuclear power station site including the indefinite and possibly permanent closure of Mississippi River to public access for commercial, sporting, recreation and other means of economic livelihood. (AL-21)

Response: *Distribution of tax monies for the existing plants is described in Chapter 2 of the EIS. The impact on government finances of construction and operation of the proposed plants will be described in Chapters 4 and 5.*

Comment: The distribution of tax revenues, and who bears the risks, and who reaps the benefits; and existence and/or adequacy of the emergency evacuation plans; and environmental justice issues, and this is huge, and class and race issues and they must be addressed. (R-2)

Response: *U.S. Nuclear Regulatory Commission staff analyzed both socioeconomic and environmental impact from an environmental justice perspective in Chapters 4 and 5 of the EIS.*

Comment: Terrorist sabotage or accidents could poison the Mississippi River, New Orleans, and the Gulf of Mexico. Damage could affect seafood industries that bring in millions of dollars of benefits to the state economy. (W-5)

Comment: All socio-economic impacts arising out of a severe nuclear accident at an expanded Grand Gulf site on the including commerce on the Mississippi River and the Gulf of Mexico fishing industry. (AL-8)

Comment: It is also near an area of the River that would allow easy access for terrorists, particularly from a boat or barge. An accident or act of sabotage at this facility and its stored nuclear waste could contaminate the Mississippi River and the Gulf of Mexico. This would be disastrous to the communities downstream that depend on the River for drinking water. Also, the extensive industrial corridor between Baton Rouge and New Orleans depends on the River water for processing. These industries would have to be shut down. Contamination of vital wetlands that provide ‘nurseries’ for larval and other developmental stages of fish, for shrimp, oysters, etc., could devastate the seafood industry. Certainly the tourist industries in Florida, Mississippi, Louisiana, and Texas would be affected. We are talking potentially billions of dollars and innumerable lives lost or changed because of an accident at this plant. (AM-9)

Comment: An accident or act of sabotage at this facility and its stored nuclear waste could contaminate the Mississippi River and the Gulf of Mexico. This would be disastrous to the communities downstream that depend on the River for drinking water. Also, the extensive industrial corridor between Baton Rouge and New Orleans depends on the River water for processing. These industries would have to be shut down and shipping on the MS River curtailed. Contamination of vital wetlands that provide ‘nurseries’ for larval and other developmental stages of fish, shrimp, oysters, etc., could devastate the seafood industry. Additionally, the tourist industries in Florida, Mississippi, Louisiana, and Texas would be affected. We are talking potentially billions of dollars and innumerable lives lost or changed because of an accident at this plant. (AO-8)

Comment: An increased threat to human health is not the only serious risk that this facility will pose, it can also be devastating economically. If the environment becomes contaminated, we can lose the very foundation upon which we depend for sustenance. Most areas along the river are agricultural, supplying the nation with food crops for human consumption and animal feed. Those crops not directly consumed by people will eventually be consumed through the foodweb. Other industries such as gaming (hunting and fishing) and seafood harvest could be destroyed. Economic collapse would be inevitable and billions of dollars lost. (AP-5)

Comment: An increased threat to human health is not the only serious risk that this facility will pose, it can also be devastating economically. If the environment becomes contaminated, we can lose the very foundation upon which we depend for sustenance. Most areas along the river are agricultural, supplying the nation with food crops for human consumption and animal feed. Those crops not directly consumed by people will eventually be consumed through the foodweb. Other industries such as gaming (hunting and fishing) and seafood harvest could be destroyed. Economic collapse would be inevitable and billions of dollars lost. (AP-9)

Comment: It is also near an area of the River that would allow easy access for terrorists, particularly from a boat or barge. An accident or act of sabotage at this facility and its stored nuclear waste could contaminate the Mississippi River and the Gulf of Mexico. This would be disastrous to the communities downstream that depend on the River for drinking water. Also, the extensive industrial corridor between Baton Rouge and New Orleans depends on the River water for processing. These industries would have to be shut down. Contamination of vital wetlands that provide 'nurseries' for larval and other developmental stages of fish, for shrimp, oysters, etc., could devastate the seafood industry. Certainly the tourist industries in Florida, Mississippi, Louisiana, and Texas would be affected. We are talking potentially billions of dollars and innumerable lives lost or changed because of an accident at this plant. (AQ-10)

Comment: It is also near an area of the River that would allow easy access for terrorists, particularly from a boat or barge. An accident or act of sabotage at this facility and its stored nuclear waste could contaminate the Mississippi River and the Gulf of Mexico. This would be disastrous to the communities downstream that depend on the River for drinking water. Also, the extensive industrial corridor between Baton Rouge and New Orleans depends on the River water for processing. These industries would have to be shut down. Contamination of vital wetlands that provide 'nurseries' for larval and other developmental stages of fish, for shrimp, oysters, etc., could devastate the seafood industry. Certainly the tourist industries in Florida, Mississippi, Louisiana, and Texas would be affected. We are talking potentially billions of dollars and innumerable lives lost or changed because of an accident at this plant. (AW-10)

Comment: Before NRC considers granting this preliminary permit, it should answer a number of questions: How would a release of radiation affect the seafood industry and agriculture in the area? (BI-6)

Response: *The economic impact of postulated accidents was evaluated, and the results are presented in Chapter 5 of the EIS.*

Comment: There are very few Port Gibson residents that have jobs at that facility. It is a small percentage, and it is a small portion. (I-2)

Response: *The geographic distribution of current Grand Gulf employment is covered in Chapter 2 of the EIS and the impact of new plants on the employment in the area in Chapters 4 and 5.*

Comment: You hear a lot about the jobs, and that is an issue that can't be avoided by anyone that wants to take the issue seriously whether a new plant makes sense or not. But I did appreciate the comments from Rose Johnson that it is a false choice or a bad choice when a community needs to choose between their health and future generation's health, and being able to have some kind of job to put the food on the table and a roof over one's head. (R-12)

Comment: It is hard to persuade other needed businesses to come to small towns, much less to come and locate next to a nuclear reactor facility, that is knowingly storing onsite, cancer causing toxic nuclear waste. In effect the permitting board is sentencing a community to die or become ill. (AJ-7)

Comment: As a historically poor state Mississippi has [lagged] behind in industrial and commercial [development]. Some might believe that we are behind the curve, I would argue that this has given us the opportunity to see how industrial and commercial [development] has affected the areas this type [development] have been implemented. At this time, Mississippi is trying to catch up and bring in new development and jobs. As a long time resident of this state I believe it is time we start looking at the consequences of such decisions, learn from what has happened and use that information to put ourselves ahead of the game. I do not believe that this plant will put us ahead of the game and make us more attractive to future [business] and [development]. (AT-3)

Response: *These comments on future business development opportunities facing the local community are not within the scope of the EIS. They have not been considered further in the staff's environmental review.*

Comment: How can we even consider adding another nuclear reactor when Entergy has failed to deliver on its 25 or so year old promise of job creation in this area. What happened, and why is there now double-digit unemployment in this area, which is one or among the highest in the state of Mississippi. And in addition to the unemployment, you have to add to that is the situation that you have a situation where the young people who work here move away. Why? Because they don't have the kinds of job opportunities that they would be interested in pursuing and they work elsewhere. (O-6)

Comment: Grand Gulf has been less than responsible to the surrounding community, specifically Claiborne County, in hiring, training, and promoting its citizens in that the majority of Grand Gulf's permanent workforce do not live in Claiborne County. (S-6)

Response: *These comments on actions not taken and not required of the applicant by any regulatory body are not within the scope of the EIS. They are not considered further in the staff's environmental review.*

D.6 Environmental Justice

Comment: The comment about the racism and where nuclear power plants are located. With 103 reactors that are in the country, a large percentage, and I would say greater than 90 percent, are located in non-minority areas. And I know that a lot of people are thinking that this is a race issue, we just need to make sure that we get the information correct, and I would say that if at all that I felt that the issue of potentially building another unit at Grand Gulf was potentially racial in nature that I would not be standing here tonight, and that is one thing that I can tell you for sure. (A-11)

Comment: And finally all of the above need to be considered as environmental justice issues given that the risks and the hazards associated with Grand Gulf site expansion disproportionately impact the people of Claiborne County, given that the county is 84 percent African-American, with 34 percent living under the poverty line, with a per capita income of $11,000 annually, and that is from the Census data from 2000. (D-12)

Comment: Once again in Mississippi, low income African-Americans are being placed at the greatest risk of harm so a greedy corporation can make big profits. To place another nuclear reactor in Claiborne County doesn't make any sense when there is already concerns about the present plant. This is a crime and blatant example of environmental racism. Claiborne County is 84 percent African-American, with 34 percent living below the poverty line. (G-2)

Comment: And chief among these enormously important issues that have got to be considered in the NEPA process is certainly environmental justice. With this project once again we are talking about an African-Community that is basically going to receive all of the burdens of this proposed project, and very few of the benefits. And that is environmental racism. (I-1)

Comment: And as the Nuclear Regulatory Commission held in the Louisiana Energy Services case just a few years ago, which I did litigate, environmental justice is used such as these have to be considered as part of the NEPA process. (I-7)

Comment: I want to echo the sentiments of the local people who talked about environmental racism. That is a genuine issue that must be considered when this application is being reviewed, and why Claiborne County, Mississippi, and why Grand Gulf Nuclear Station. As our African-American population continues to thrive, and our Caucasian population diminishes, 20 years from now what will the population be. As we study demographics across the Nation, we already know that we can project what the population in this community will be, and we just reiterate those comments regarding environmental racism. And I call upon the governing body of this county tonight to be ever mindful of the tax inequity that exists, and I don't know if this is an NRC problem, or a state of Mississippi problem, or what. But there is a tremendous tax inequity that currently exists with regard to the distribution of tax dollars. And this should not be about money, and I hope that we don't sit down and say that if all of the tax dollars could come here, then we should be for the approval of this permit. But certainly the reverse is that why should we assume the risk and distribute those funds, those resources, across the state of Mississippi to people who are less at risk than we are. Let's keep that in mind, and I direct those comments specifically to the residents of Claiborne County, and ask that we constantly call upon our elected officials to do everything possible to see that the NRC and this application process is taken seriously, and to see that those tax dollars are returned to Claiborne County if there is going to be a second site here. (J-1)

Comment: I wanted to begin my comments by focusing on the Louisiana Energy Services case. It was in this case that two African-American communities in Louisiana, the communities of Forest Grove and Cedar Springs, were successful in stopping the licensing of a uranium enrichment facility on environmental justice grounds, and the decision maker was the Nuclear Regulatory Commission. In that case the Nuclear Regulatory Commission was compelled to set up a very important national environmental justice precedent, and in that decision I quote the Nuclear Regulatory Commission held, and I quote, that this great impact analysis is our principal took for advancing environmental justice under the National Environmental Policy Act. The NRC's goal is to identify and adequately weigh and mitigate the effects on low income and minority communities that become apparent only by considering factors peculiar to those communities. (O-1)

Comment: The risk to public health, safety, and security associated with building more atomic power plants at the Grand Gulf site is disproportionately placed on the people of Claiborne County and the surrounding communities. (S-10)

Comment: Entergy wants to dump yet another dangerous facility on the mostly African American residents who live in Claiborne County, which is 82 percent African American. This is a clear case of environmental racism. (U-3) (X-13) (AE-3) (AH-3) (AI-3) (BD-7) (BE-3) (BF-4) (BH-3)

Comment: Claiborne County, where this dangerous facility will be dumped, is 82 percent African American, which unfortunately evokes the issue of environmental racism. (W-3)

Comment: A third important concern is environmental racism. Entergy wants to dump yet another dangerous facility on the mostly African American residents who live in Claiborne County, which is 82 percent African American. The adverse impacts from this project will disproportionately impact a racial minority group with weak political and economic means to advocate on it behalf. This is a clear case of environmental racism. Please deny this request for an early site permit for expansion of Grand Gulf Nuclear. (Z-3)

Comment: Entergy wants another nuclear facility in the backyards of the mostly African American residents who live in Claiborne County, which is 82 percent African American. This is a clear case of environmental racism. (AA-3)

Comment: In addition, and specific to the Port Gibson facility, I object to yet another "undesirable" facility being located in a predominately African-American community. (AC-4)

Comment: Additionally, this proposal raises significant environmental justice issues. Claiborne County is 82 percent African American. The placement of this facility within Claiborne County would, therefore, have a disproportionate effect on African American communities. (AD-5)

Comment: 82 percent of Claiborne County is African American, making the proposal to put another dangerous facility in this community a clear case of environmental racism. (AF-4)

Comment: The community surrounding the facility is 82 percent African American, which makes this proposal ring of environmental racism. (AG-3)

Comment: The nuclear facility is located in a small town, mostly minority, low income, residential community, called Port Gibson, Mississippi. (AJ-2)

Comment: There is and will be a disproportionately high and adverse impact on low income or minority populations. (AJ-12)

Comment: The time is past for the people and the Nuclear Regulatory Commission to allow (permit) facilities that generate vast amounts of toxic air pollution, soil contamination, water pollution and toxic radioactive wastes that has to be stored onsite or disposed of in some other community that doesn't want it. This could be considered another Environmental Justice issue! President Bill Clinton's Executive Order 12898 in it's ruling "To the greatest extent practible and permitted by law... each federal agency shall make [achieving] Environmental Justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health, or environmental effects of its programs, policies, and activities on minority populations and low income populations in the United States." The last time I checked Port Gibson, Mississippi is still in the United States, therefore why would the commission even consider permitting this facility in a low income minority community? Companies, industries and others should be ashamed of themselves and not be allowed to bribe or coerce the citizens desperate for jobs into acceptance of (with the offer of good paying jobs, positive economic impact or other incentives) or exchange for industries that spew toxic pollution on the people! (AJ-16)

Comment: All of the above need to be considered as environmental justices issues given that the risks and hazards associated with the Grand Gulf site expansion disproportionately impact the people of Claiborne County given that the county is 84 percent African American with 34 percent living under the poverty line at a per capita income of $11,000 annually. (AL-13)

Comment: I have heard much discussion of environmental racism and also believe this is a relevant issue. Claiborne county is largely minority in population – I don't believe this plant would be considered in a wealthier, more affluent area. (AM-4) (AQ-4) (AW-5)

Comment: I have heard much discussion of environmental racism and also believe this is a relevant issue. (AS-8)

Comment: IT'S ABOUT JUSTICE. Entergy wants to dump yet another dangerous facility on the mostly African American residents who live in Port Gibson. This is a clear case of environmental racism. Why do Entergy and other polluting companies promise only dangerous and dirty jobs to African Americans and other people of color? (BG-8)

Comment: Before NRC considers granting this preliminary permit, it should answer a number of questions: Will this facility affect communities of color more than other communities? (BI-7)

Comment: This may be a siting decision now, but the considerations range far beyond geological stability and availability of plentiful cooling water. This is a decision to saddle an economically depressed county with greater risk in order to produce electricity by one of the most expensive and environmentally unsound methods that exists today. (BI-9)

Comment: Entergy wants to dump yet another dangerous facility on the mostly African American residents who live in Claiborne County, which is 82 percent African American. This is a clear case of environmental racism that ignores significant impediments to emergency planning to safeguard area residents in case of an accident or act of terrorism at the facility. We believe it is no accident that low-income African Americans in Mississippi are being placed at the greatest risk of harm so a large corporation can make big profits. Entergy would not be trying to build the first new nuclear plant in decades in the U.S. in predominantly white Madison or Ridgeland, Miss. Just like you don't have hog factories, creosote waste sites and chemical plants located next to these affluent, white communities. This is another example of environmental racism in a state where African Americans are already bearing the brunt of the pollution burden. African American women in Mississippi have the worst health of any population group in the U.S. Adding additional sources of dangerous pollution is simply unacceptable. It is a blatant case of environmental racism to expect this community to accept the risk from building another nuclear power plant considering concerns about health impacts from the present plant and the threat of terrorist attacks. This would simply make the terrorist target bigger. (BJ-3)

Comment: Here in California, we site hazardous waste facilities in poor Hispanic areas. I guess in Mississippi one uses poor black areas. I am told Claiborne County, is 82 percent African American; do many of low income minority persons live near the proposed Power Plant? (BL-3)

Comment: I have heard much discussion of environmental racism and also believe this is a relevant issue. Claiborne county is largely minority in population – I don't believe that this plant would be considered in a more affluent area. (BN-4)

Comment: 82 percent of it population is African American. This is a clear case of environmental racism. (BO-3)

Comment: Justifying permit because of the economic benefits they provide is disgusting. Projects should not be allowed to destroy the public health safety, and welfare of any community, especially a low income, minority community that does not have the political clout, financial clout or resources to fight these terrifying nuclear reactor projects! By not having the resources available to fight this situation, this could be an Environmental Justice issue in itself! I sincerely believe this to be an Environmental Justice problem and hope that some health organization or environmental group will be notified of this project and join together to fight against this project and be prepared to file lawsuits challenging this permit request. Why do these types of projects never request to be located in densely populated upper class (white-Caucasian) communities, such as Madison, Clinton, or North Jackson? (AJ-14)

Response: *Environmental justice analysis in a U.S. Nuclear Regulatory Commission (NRC) EIS deals with disproportionate environmental impact on low income and minority communities, including socioeconomic impact. NRC staff analyzed socioeconomic impacts from an environmental justice perspective in Chapters 4 and 5 of the EIS.*

Comment: Before NRC considers granting this preliminary permit, it should answer a number of questions: Would the benefits from any jobs related to the construction and operation of a second nuclear facility be fairly distributed. That is, will this project mean good jobs with good benefits to the African American residents of Claiborne County? (BI-8)

Response: *Whether current or future Claiborne County residents will be hired for construction and operations jobs would depend on a number of factors, including job requirements, occupational skills of the local workforce, and availability of training programs. The geographic* *distribution of current Grand Gulf employment is covered in Chapter 2 of the EIS and the impact of any new plant(s) on the employment in the area in Chapters 4 and 5. Issues with the equity of hiring practices and equal employment opportunity are the responsibility of the U.S. Equal Employment Opportunity Commission and are not considered further in the staff's environmental review.*

Comment: I attended an environmental justice workshop that was put on by the government, ATSDR, and other agencies, in Weblin, Mississippi. At that meeting, there were chiefs of some Indian nations that came to speak about the contamination of their sacred lands by uranium mining. They talked about how difficult it was to tell their people to not eat the fish out of the stream. Do not eat the deer. They are contaminated. Well, these are their sacred lands, and these are the lands that have supported them for many generations, and now they can't use them anymore. (K-2)

Response: *The impacts of the uranium fuel cycle including the onsite storage and eventual disposal of the spent fuel is considered in Chapter 6 of the environmental impact statement. Guidance on the approach is provided in the U.S. Nuclear Regulatory Commission environmental standard review plan (NUREG-1555, Section 5.7).*

Comment: It doesn't have to be that way, and we showed them in Louisiana that we can stop licensing of dangerous and hazardous facilities in our African-American communities, and we will show them again. (O-8)

Response: *This comment provides only general information in opposition to the Grand Gulf early site permit and is not considered further in the staff's environmental review.*

D.7 Radiological Impacts

Comment: Impacts on plant and animal life, and the fish in the Mississippi, and everything that is revolving in that biosphere surrounding Grand Gulf and that biosphere generally and we humans that live in it. (R-4)

Comment: We need to build on our [resources] and enhance our state. One of our largest resources in the state of Mississippi is our natural environment. The river, the forests, the land. By building a power plant we risk destroying and or [polluting] these resources. It is time for the state of Mississippi to start protecting and preserving its natural resources before it is too late. I believe that by allowing Grand Gulf Nuclear to expand its facilities, we are expanding our potential to harm our natural resources and citizens. (AT-4)

Response: *The impact on the Mississippi River arising from the release of radioactive materials into the Mississippi River from the operation of additional nuclear power units will be reviewed in accordance with the environmental standard review plan (NUREG-1555) and discussed in the EIS in Sections 4.3 and 5.3.*

Comment: The Claiborne County residents want what any other community desires; their god-given right to breath clean air, and drink clean water. (G-7)

Response: *The comment provides only a general statement and is not considered further in the staff's environmental review.*

Comment: All impacts on public health and environment arising out of the increase in routine or accidental releases of radioactive gas, and particulate to the air and to our water as it settles on to our land and our agricultural soil as the result of the operation of additional units. Clearly, this analysis should be taken in the most vulnerable of our population, not the most robust, and so we need to be looking at the impact of increased bioconcentration of radioactive isotopes. So while they say that the impact is small, and the releases are minute, we need to realize that there are isotopes that are being routinely released by this plant, like cesium-135, that has a half-life of over 2 million years. So every day that plant operates, and that one isotope, and dozens of isotopes gets out in the environment, it is going to persist in the environment for – well, an effective half-life. And if you want to really get rid of all the hazardous life, you multiply that half-life figure by 10, and that will give you some idea of how long that isotope can be accumulating in the environment, and biomagnifying up through the food chain, and getting through mother's milk, or through the uterus, or in any other number of ways and accumulate. And so all this environmental impact statement needs to be looking at is all and new published data that looks at the epidemiological impact of the routine and accidental emissions. (D-10)

Response: *The early site permit process is designed to determine if the site is suitable for one or more nuclear power reactors. The EIS assessment will contain an analysis and evaluation of components of the facility relating to the potential radiological consequences. Chapters 4 and 5 of the EIS will address health impacts related to construction and operations.*

Comment: From an environmentalist standpoint for us to build a second site in close proximity of the first unit, and we are talking about over a period of years; whereas, beginning from day one some 20 years ago when Entergy first built the site, they have refused to put one penny into a study to even conduct studies in terms of any help related that perhaps may have come from that site. I don't see us getting into without some kind of commitment based upon some studies here for the local residents, and here with an increase in cancer, or the increase in other various kinds of disease that could have been related to the site, and without any of that, I don't see us proceeding with a second Grant Gulf unit here. (H-1)

Comment: And at the reactor site and the area surrounding it, people are concerned about cancer, and the growing rates of cancer, and what we know that it is a scientific fact that nuclear radiation causes cancer, period. And Entergy's nuclear reactor, the proposed one that we are now talking about, would definitely increase radiation levels as part of its routine operation. (O-4)

Comment: There is a lack of an adequate epidemiological study of the health effects of radiation releases on the residents of Claiborne County from the routine operation of Grand Gulf atomic power plant and any new reactors. (S-7)

Comment: Concerns about elevated cancer rates and the failure of state health authorities to conduct epidemiological studies of the surrounding population. (BD-6)

Response: *The EIS will contain an analysis and evaluation of components of the facility relating to the potential radiological consequences. Chapters 4 and 5 of the EIS will address the health impacts; however, epidemiological studies are outside the scope of the EIS.*

Comment: So I am saying that this is not just a local issue. It is a global issue. [Chernobyl] gave off radiation 2000 miles away, and so anything that happens here could contaminate a good portion of the world. (K-3)

Comment: As nuclear power proliferates, the availability of highly radioactive building materials which can be used deliberately or accidentally to injure individuals and groups of people increases. Do we all have to buy our own personal Geiger counters so that a handful of corporate executives can enjoy the satisfaction of propping up a failed industry? (X-8)

Comment: The electricity generated at this facility would be sold to other states, why should my state be polluted and Mississippians be exposed to harmful toxic radioactive waste so others can have electricity? The Nuclear Regulatory Commission should permit nuclear reactor facilities to be located where the people receive the benefits and the toxic exposures. (AJ-10)

Comment: The nuclear power industry has historically evaded environmental regulations and shown disregard for the public health, safety, and welfare of nearby or far residents. Please remember towns like Anniston Alabama and PCB pollution, millions of dollars do not replace or pay for good health! (AJ-17)

Response: *These comments refer to health impacts. The EIS impact analysis will contain an analysis and evaluation of components of the facility relating to the potential radiological consequences. Chapters 4 and 5 of the EIS will address health impacts.*

Comment: When I passed by the nuclear power plant, I seen the steam coming up, and I noticed the storage there, and I wondered if I was going to get zapped going by here today or not. In my community here, I am talking to people sometimes, and they have an ailment, and a lot of them went to a lawyer, and you know, I didn't have all these things happening, you know, and I wonder if it is that nuclear power plant. (F-2)

Comment: But the fact is that it is not safe. Radioactive release remains very toxic to all life for thousands, to millions, of years. (G-5)

Comment: Residents of Port Gibson are exposed to radiation from the existing facility, and obviously now more exposure is proposed, because we are talking about another facility, another facility that has in fact the capacity for 2 or 3 reactors, and that is possible. Nobody can deny that scientists have documented that radiation exposure increases the risk of cancer and all kinds of serious health problems; birth defects, still births, and the science is there, absolutely. (I-5)

Comment: You would not have to wait for a catastrophe to happen at the reactor to have radiation emissions. These reactors are not as was said earlier emission free, and as part of their daily routine operations, they are leaking and emitting radioactivity into our air, land, and water. (O-5)

Comment: I hear this at every NRC meeting that I go to practically, even if it is not about reactors, because I deal a lot with low level nuclear waste, and not the stuff that will kill you in like 5 minutes if you were next to it, and it wouldn't be in the water, but the stuff that would give you cancer within 10 years or 30 years, and so forth. And that is about radiation and how it is a fact of daily life. We have heard a lot about how the NRC has deemed that the routine releases from plants are safe and pose no substantial health risks to humans. We are told that we live with radiation all around us every day, and that radiation is just another fact of life, but an important distinction to make here is that between radiation exposures that people can't reasonably avoid, unless a person becomes a very desired lifestyle, and wants to avoid the sun completely, and never fly in an airplane to visit relatives on the other side of the world, it is true that there is a lot of radiation out there in nature that is difficult to avoid. But ionizing radiation that comes from a nuclear reactor is an entirely different matter, and that has to do with activities of mankind and how we deal with technology. So it creates a whole other issue that needs to be addressed and if you have exposure to radioisotopes that are in your drinking water, and in the soil, and in the air, that is a whole other matter than a little bit of radiation that may be in a banana. So I just think that it is time to put that to rest, and the whole idea that it is a radioactive world and so let's just throw some more into it. It is time for – you know, that is kind of absurd. (R-5)

Comment: All impacts on the public health and environment arising out of the increase in routine and accidental radioactive emissions to the air and to the water as the result of the operation of additional nuclear power units. The analysis should consider work by Dr. John Gofman, showing that low-level radiation, at levels considered to be safe for medical use, is a significant contributor to deaths from heart disease and cancer. See Radiation from Medical Procedures in the Pathogenesis of Cancer and Ischemic Heart Disease (Committee for Nuclear Responsibility: 1999). (AL-6)

Comment: IT'S ABOUT HEALTH. The daily operation of nuclear reactors release radioactivity into our air, water, and soil that can damage human health. It is scientifically established that being exposed to radiation increases your risk of cancer and other severe health problems. Health studies have linked nuclear reactors to increased cancers, leukemia, reproductive damage, still births, and birth defects. (BG-3)

Comment: IT'S ABOUT A CLEAN ENVIRONMENT. Entergy admits that it wants to build a nuclear reactor that would have the capacity equal to two very large reactors. If licensed, this reactor would generate harmful, radioactive waste, daily pollute the air, water, and soil with radiation, and threaten the lives of people with the potential for a nuclear catastrophe. (BG-4)

Response: *The purpose of radiation regulatory limits are to protect workers and the public from the harmful health effects of radiation on humans. The limits, including effluent release limits, are based on the recommendations of standards-setting organizations. Radiation standards reflect extensive ongoing study by national and international organizations (International Commission on Radiological Protection [ICRP], National Council on Radiation Protection and Measurements, and National Academy of Sciences) and are conservative to ensure that the public and workers at nuclear power plants are protected. The NRC radiation exposure standards are presented in 10 CFR Part 20, "Standards for Protection Against Radiation," and are based on the recommendations in ICRP 26 and 30. In addition, the U.S. Environmental Protection Agency has established a whole body dose limit of 25 millirem per year (see 40 CFR Part 190). Finally, Appendix I in 10 CFR Part 50 provides dose design objectives for exposure of the public to radioactive effluents from nuclear reactors. Numerous scientifically designed, peer-reviewed studies of personnel exposed to occupational levels of radiation (versus life-threatening accident doses or medical therapeutic levels) have shown minimal effect to human health, and any effect was from exposures well above the exposure levels of the typical member of the public from normal operation of a nuclear power plant. Regarding health effects to populations around nuclear power plants, NRC relies on the studies performed by the National Cancer Institute (NCI). NCI conducted a study in 1990, "Cancer in Populations Living Near Nuclear Facilities," to look at cancer mortality rates around 52 nuclear power plants, nine U.S. Department of Energy (DOE) facilities, and one former commercial fuel reprocessing facility. The NCI study concluded from the evidence available that there is no suggestion that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers in populations living nearby. Additionally, the American Cancer Society had concluded that although reports about cancer case clusters in such communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than* *they do by chance elsewhere in the population. The issue of radioactive effluents and their impacts on human health are evaluated in Chapters 4 and 5 of the EIS.*

D.8 Uranium Fuel Cycle and Waste Management

Comment: In addition, there is substantial doubt about the ability to develop a large amount of nuclear power without a complete reconstruction of the U.S. Department of Energy nuclear fuel refining process, an expense which should not be borne by the taxpayer in a deregulating electric market, and which cannot be borne by the utility industry if new nuclear plants are to pass the laugh test. (X-5)

Response: *The comment is noted. Restructuring of the U.S. Department of Energy is outside the scope of this environmental review. The impact of the uranium fuel cycle, including the onsite storage and eventual disposal of the spent fuel, is considered in Chapter 6 of the environmental impact statement. Related U.S. Nuclear Regulatory Commission (NRC) staff review guidance is provided in the NRC environmental standard review plan (NUREG-1555, Section 5.7).*

Comment: I guess there was one question about spent fuel capacity. The spent fuel capacity at Grand Gulf is capable of storing fuel in the spent fuel up until 2007. Now, what happens after that, and this technology has already been used at several of our sites, and across the company, utilities have moved towards dry cask storage. That is a technology that has been used for the low radiation fuel bundles, bundles that have been out of the reactor for a significant period of time, such that the dose is relatively low. And these bundles can be safely stored in a dry cache storage facility on the site. It is still on the site location, and many utilities use that already. But with that technology, we can store fuel for as long as it takes to have an alternate main storage for fuel elsewhere, such as Yucca Mountain. (A-8)

Comment: I first would like to say that one of our major concerns here is that we have been talking about nuclear waste, and I know that is a big issue. If I recall, there were 3500 assemblies, and 800 pounds per assembly. That is over a thousand tons there at Grand Gulf sitting in that pool with an uncertain future. And now we are talking about increasing the amount of nuclear waste that could be generated there. And it will be where it is if there is no other place for it to go, and you should be considering that, and certainly the environmental impact statement that we are talking about here is to address that. We also want to know about all impacts arising from the additional accumulation of high level radioactive waste generated and indefinitely stored on the Grand Gulf nuclear site as I originally discussed. (D-2)

Comment: Nuclear power produces extremely hazardous waste from the cradle to the grave. There is dangerous radiation waste from mining uranium, from processing it into fuel, and then from waste material left over after it is used to make power. (G-3)

Comment: One point that I wanted to make on used fuel management. There has been a lot of discussion about can I stand in a room with spent fuel, and is it dangerous. What was not said about used fuel. I have been in a room with used fuel several times. I have taken tours of reporters and policy makers into a used fuel storage room. The fuel is under 30 feet of water, which is a shielding agent for the radiation, and so you can go in this room with the appropriate radiation monitors on, and you can stand in there and look at the pool. You don’t want to stand in there a long time, but you are perfectly safe to go into this facility and look at the fuel. The same thing with the dry storage containers that Mr. Williams referenced. These containers are safe, and they are approved by the NRC as safe. You can walk up to one and stand there, and you will not get any heath impacts by standing next to one of these containers. About 28 companies already have gone from using pool fuel storage to these dry storage containers. They are made of concrete and steel, and as one speaker said, you take the oldest fuel out of your fuel pools, and put it in these containers, and you store these on-site with security added to that facility. (M-9)

Comment: The waste issue would be dealt with in this current EIS based on the life of the plant, the life of the nuclear facility, which I am not sure now, but it used to be 20 years, and maybe it is 40 years now. And I don’t believe that at that point that there will be a facility to store this waste, and concrete and metal dry casks do not last tens of thousands of years. So I think there is a lot of considerations that need to be dealt with. (Q-3)

Comment: And the best solution found for the waste being just throwing it in a hole in the ground is disturbing. Let’s see. The myth that nuclear is a clean air energy, and there is a lot to say here, but the proponent of nuclear energy would like us to believe that uranium fuel rods simply and magically appear in a nuclear reactor’s core. This is not the case, and the process is neither simple nor magic. From the front end to the back end of the uranium fuel cycle, there is a considerable reliance on fossil fuels. Uranium mining and uranium milling, processing, and fuel fabrication, all require fossil fuel use in order to deliver fuel rods to the reactor. And, of course, this does not even begin to cover the unfathomable amounts of energy to create a Yucca Mountain, and/or to ship the nation’s high level waste from the reactors across the country to the site, or in this case to the sites if we need more than one. (R-6)

Comment: The Grand Gulf site is already accumulating highly radioactive waste without an approved and scientifically valid long-term nuclear waste management site and more atomic power plants would make the radioactive waste problem for Claiborne County worse. (S-1)

Comment: No one knows what to do with the spent nuclear fuel that we have right now. Why generate any more? (AB-3)

Comment: The radioactive waste issue. I am not satisfied with the current means of disposal of nuclear waste. I have heard of no method of disposal of such waste that I consider acceptable. (AC-3)

Comment: Entergy has publicly admitted that by the year 2007 it will no longer have the capacity to store on-site the radioactive waste generated by the current Grand Gulf reactor. Additionally, it is well known that Yucca Mountain when fully operational will not possess sufficient capacity to receive existing waste. Thus, allowing expansion of the proposed expansion will only exacerbate current problems associated with storage and/or disposal of radioactive waste generated at the Port Gibson facility. (AD-2)

Comment: I have been told that the Grand Gulf Nuclear Reactor facility at Port Gibson has publicly stated as of the year 2007, it would no longer have storage capacity onsite for the toxic radioactive waste it is already generating. Where will the old waste and the expected new waste go in the future? To quote the Utah Governor Mike Leavitt who is adamantly opposed to the dumping of toxic waste, “It’s pretty clear that utilities are willing to spend billions to move spent fuel out of their backyard into ours”... (AJ-11)

Comment: All impacts arising from the additional accumulation of high-level nuclear waste generated and indefinitely stored on-site at the Grand Gulf nuclear power station as the result of the operation of additional nuclear power reactors. This discussion is required, given that the Waste Confidence Rule applies only to waste generated by “existing facility licenses.” 55 Fed. Reg. 38,474 (September 18, 1990). (AL-5)

Comment: In the past, contractors have not met specifications in building plants, unexpected accidents have occurred, and there is still no safe way of disposing of nuclear waste – I expect the plans are for it to stay by the MS River until opposition to the waste being shipped across the country ends. (AS-4)

Comment: Most of my concern is over the continued inability of the nuclear industry to safely dispose of its waste. The bottom line is that there is no safe, long-term, economically viable way to manage this “output.” The much-touted “input-output” claims of the industry, which is that the public gets more benefits to cost than from other fuel sources, is not true, when all the real expenses are added in. This means construction, maintenance, use of water and other “inputs,” as well as the byproducts (waste) and the collection, storage, transfer, etc. Of course, radiation is a problem that lasts for thousands of years, and is a cumulative effect that no number-crunching can tally. (BC-4)

Comment: While a plant like Grand Gulf may be staffed by competent people and enjoy a commendable safety record, the ugly fact of nuclear waste (48 tons produced annually at the plant) cannot go ignored. A plant official at the recent NRC environmental scoping meeting in Port Gibson stated that on site nuclear waste storage would reach capacity by 2007! To propose construction of new reactors creating even more deadly waste that will still be around thousands of years from now is not just folly, it is the height of arrogance. (BD-3)

Comment: Through a company called "System Energy Resources, Inc.," the Entergy Corp. is seeking a permit that would allow it to build one or more large nuclear reactors next to Entergy's Grand Gulf nuclear reactor in Port Gibson, MS. Entergy publicly admits that by the year 2007 it will no longer have the capacity to store on-site the radioactive waste generated by the current Grand Gulf reactor. Entergy's plans for new nuclear reactors will create more dangerous radioactive waste, and further threaten the health and lives of people who live, work, and attend school in Port Gibson. Here are some important facts. (BG-2)

Response: *The impact of the uranium fuel cycle, including the onsite storage and eventual disposal of the spent fuel, is considered in Chapter 6 of the EIS. Related U.S. Nuclear Regulatory Commission (NRC) staff review guidance is provided in the NRC environmental standard review plan (NUREG-1555, Section 5.7).*

Comment: I cried, because I was so sad that there is a possibility that we are going to be adding another nuclear plant. It's like let's double the amount of poison that we are going to give to our children as their inheritance. Yucca Mountain, that's a dream. That is something that is not going to happen. If it does happen, it will be a disaster. (C-1)

Comment: There is another burden. All of the tons of toxic radioactive waste that have been produced at Grand Gulf are sitting right here on the site. A lot of people don't know that everywhere the county that if you have a nuclear reactor, you have got all of the tons, and tons, and tons of waste that they have produced right there on site, and that is not going to change. It is not going to change. The proposed Yucca Mountain repository for all this nuclear waste that has been talked about for years, and years, and years, and years, is not going to be available for years, and years, and years, if at all. There are well respected scientists who have been weighing in on Yucca Mountain saying that in essence, in layman's terms, what, are you nuts? You can't put nuclear waste there. And let's just assume for a minute that Yucca Mountain ever becomes a reality, what you all need to know in this community is that Yucca Mountain would already be full when the current Grand Gulf facility reactor reaches the end of its operating life. So this pipe dream out there about Yucca Mountain, which I think is a total pipe dream, and if you don't want to believe the pipe dream, fine. But even if it is not a pipe dream, it is not going to be available for the waste from what you have here now, and any additional waste that you get in the future. (I-4)

Comment: And one is that I just absolutely believe that no more nuclear waste should be generated, and if that is not supposed to be dealt with at this point in the process, then it shouldn't be, because I don't think when you generate these deadly wastes that are going to be around for tens of thousands of years, that is an issue that should be dealt with before anything else is considered. I mean, we have billions of dollars in superfund sites now that have not been cleaned up, and in decades have yet to be cleaned up, and we are depending on the government for that, and they aren't funding it, and I think that this is the same kind of situation. If you can't deal with it, and if you can't store it, and if you can't get rid of it, then you shouldn't produce it. (Q-1)

Comment: I am writing to remind you of the experience in Massachusetts when one of our two nuclear plants was closed down some years ago. It has become, to all intents and purposes, a nuclear waste dump. Despite decades of effort by the federal government there is still no approved site to store spent radio active fuel rods and reactor parts, which will be radio active for hundreds of years. You know that the state of New Mexico is still fighting a partially completed underground storage facility and the state may well succeed. The fact is that even the most pro-nuclear power proponents want a nuclear waste facility in their neighborhood. Surely, the licensing of new nuclear facilities should be held back until there is available a secure site for spent fuel rods. (Y-1)

Comment: Also, since there is nowhere in the country to dispose of, or better yet, recycle these highly toxic, long-lived wastes, I believe that no permits should be granted for future nuclear power plants. (AM-6)

Comment: Also, since there is nowhere in the country to dispose of, or better yet, recycle highly toxic, long-lived nuclear wastes, I believe that no permits should be granted for future nuclear power plants. (AO-5)

Comment: Also, since there is nowhere in the country to dispose of, or better yet, recycle these highly toxic, long-lived wastes, I believe that no permits should be granted for future nuclear power plants. (AQ-6)

Comment: We have not come up with solutions to dispose of the waste safely. (AU-2)

Comment: Also, since there is nowhere in the country to dispose of, or better yet, recycle these highly toxic, long-lived wastes, I believe that no permits should be granted for future nuclear power plants. (AW-7)

Comment: Beyond concerns I have about nuclear power plants operations, I am opposed to the construction of new nuclear facilities until the government [satisfactorily] deals with the nuclear waste these facilities already create. (AX-2)

Comment: It is madness to expect future generations for thousands of years to live with the extremely long-lived and hazardous waste that results from nuclear power production. Once fossil fuels run out in a hundred years or so, there could be wide ranging economic disruption that would make it extremely difficult to continue to safeguard nuclear waste. It is a sin against future generations to leave this legacy of poison as the most lasting hallmark of our generation. (BJ-5)

Comment: As a person in Nevada who is deeply concerned about the Yucca Mountain project and the fairness of the NRC licensing process in regard to that project, I am worried about the Commission's consideration of permits for new reactors. The license application has not yet been written for Yucca Mountain so NRC should certainly have no reason to believe that there will be a disposal site for any waste produced by new reactors. Indeed, even if Yucca Mountain were to be licensed, it's legal limit would be reached before any waste from new generation was disposed. (BK-1)

Comment: The people of Nevada are worried that the process will be tilted to the benefit of the Department of Energy and the commercial nuclear industry when the NRC evaluates a license application and determines whether or not Yucca Mountain should be granted a license. Right now there are magnitudes of uncertainty about the ability of Yucca Mountain to isolate waste and no justification for approval of new waste production. (BK-2)

Comment: Also, since there is nowhere in the country to dispose of, or better yet, recycle these highly toxic, long-lived wastes, I believe that no permits should be granted for future nuclear power plants. (BN-7)

Comment: In addition to the inherent risks to the environment of nuclear power, including disposal of low and high-level radioactive waste, and in addition to the high cost of decommissioning nuclear facilities, I oppose this permit for the undue risk it poses to the communities in its shadow and to the residents of New Orleans in the even of a severe accident. (BI-2)

Response: *The environmental impacts of postulated accidents are evaluated and the results of the staff's analysis are presented in Chapter 5 of the EIS.*

D.9 Decommissioning

Comment: Whether existing reactors or looking at new ones, but what about when the plants shut down and eventually that has got to happen at all of these, even if they do the 40 years, plus the additional 20 that nearly all of them are applying for. They have got to shut them down at some point, and it will only make sense for them to shut them down instead of continuing to make repairs. You have decommissioning, and the enormous costs of that, and there was a recent GAO report that indicated that a lot of nuclear plant owner/operators were not doing their best at maintaining the funds that they needed to have built up in order to do a proper decommissioning, which of course has a lot to do with environmental issues. Once they leave, are they going to leave behind a clean site that people would feel comfortable getting close to, or having a park on, or you name it. Is it going to be a green site some day. (R-11)

Response: *The environmental impact from decommissioning a permanently shutdown commercial nuclear power reactor is discussed in Chapter 6 of the EIS. In addition, Supplement 1 to NUREG-0586, Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, which was published in 2002, may provide information on expected impacts from decommissioning.*

D.10 Cumulative Impacts

Comment: A cumulative impacts analysis is a fundamental and critical part of NEPA, and it can't be trumped by any agency or commission. (I-9)

Comment: All impacts arising from the simultaneous operation of the existing and aging Grand Gulf nuclear power reactor in close proximity to any new proposed advanced reactor design, including the possibility of multiple, simultaneous accidents, whether related (e.g., by fire or natural disaster) or unrelated. (AL-9)

Response: *The cumulative impact associated with the construction and operation of the proposed nuclear power plants is evaluated in Chapter 7 of the EIS.*

Comment: The issue for the NRC is not to look at this proposed reactor in a vacuum. It has got to look at this reactor and connection with the existing reactor that is in Port Gibson here. (O-3)

Response: *The U.S. Nuclear Regulatory Commission's EIS Chapter 7 discusses the cumulative impacts associated with the construction and operation of any new nuclear power plants at a site with existing nuclear power plants.*

Comment: All impacts on public health and safety arising out of a severe accident, including the impacts of the accident itself, sheltering, evacuation, radiation exposure treatment and reoccupation or relocation of entire communities in the event of an accident at an expanded Grand Gulf site. (AL-7)

Response: *As part of the U.S. Nuclear Regulatory Commission's site safety review, the staff considered whether the site characteristics are suitable for the addition of one or more additional nuclear power reactors. The environmental impacts of postulated accidents were evaluated, and the results of this analysis is presented in Chapter 5 of the EIS.*

D.11 Alternative Energy Sources and Conservation

Comment: A fourth concern is the need and the existence of feasible alternatives for power generation. The existing Grand Gulf facility involved significant cost overruns and there is a genuine question whether it has been a cost effective operation. Before expanding this facility further the NRC should require a compelling case of public need for [additional] energy generation in this service area. (Z-4)

Comment: According to Entergy, energy from the plant is not needed at this time. I believe the Site Permit should be denied because there are more viable alternatives to nuclear power and that the money spent on nuclear issues would better be spent developing these alternatives in the state. (AM-5)

Comment: According to Entergy, energy from the plant is not needed at this time. I believe the Site Permit should be denied because there are more viable alternatives to nuclear power and that the money spent on nuclear issues would better be spent developing these alternatives and in promoting energy conservation in the state. (AO-4)

Response: *In accordance with 10 CFR 52.18, the environmental impact statement prepared by the U.S. Nuclear Regulatory Commission (NRC) in conjunction with the early site permit application does not include a discussion of the need for power. NRC practice regarding need for power assessments is consistent with judicial precedent. As part of NRC's compliance with the National Environmental Policy Act, need for power is addressed in connection with the construction of a new nuclear power plant so NRC may weigh the likely benefits (for example, electrical power) against the environmental impact of constructing and operating a nuclear power reactor. In considering the need for power, the NRC does not supplant the states that have traditionally been responsible for assessing the need for power facilities and their economic feasibility and for regulating rates and services.*

Comment: Hydro is being torn down. That leaves nuclear as the only other emission-free source of electricity generation that we have to meet our growing economy. ...the only other option we have is an expansion of nuclear energy using advanced technologies. The smart way to approach that, and this is what Entergy is looking at, and this is what Virginia power, Dominion Energy is looking at in Virginia, and it is what Exelon in Illinois is looking at, is maximizing the value of sites that we have today. (M-3)

Comment: All of our electricity sources have environmental impacts. Every single one of them. The chemicals that they use in the solar industry are toxic, and arsenic is one of them. It never goes away. So they all have drawbacks, every single one of them. Nuclear and wind, when you look at the total lifecycle of these facilities, have the least environmental impact, and they are right there together. There have been studies done in Europe, and there have been studies down in Japan, and when you look at the cradle-to-grave application of nuclear and wind, they are by far the lowest. We have those independent studies on our website if you would like to see them. It is www.nei.org. (M-7)

Comment: The impact of that is rising natural gas prices, both for industries that use natural gas as a feed stock – the chemical industry, the fertilizer industry – and our home heating bills for those of us who use natural gas for heating. So there is an impact, a secondary impact, to an over-reliance on any single fuel source. We are blessed in this country with diversity of fuel supply options for electricity, and we have to continue to use all of them. (M-8)

Comment: But if the Federal Government and the Department of Energy have finally gotten the idea of global warming and the concerns of that, then I think that is great. As to which is the most noxious (inaudible) effects, they brought in fossil fuels, or the nuclear energy, I am not sure. They are both pretty bad. (P-2)

Comment: What I would like to suggest, and which has not been brought out, was to put in a plug for energy conservation. They have these sprinkle replacement light bulbs that you can screw in and replace a 60-watt light bulb and it gives just as much light on about 13 watts, and it costs about two bucks a piece now, $2 to $3, and it pays for itself in about a month in just the energy saving there. But it is even more so in the summer time because I have to have air-conditioning to pump out all of that extra heat that is given off of it, and so that is just one of many. And the Federal Government sponsored this energy star program, and we need to have more of that, and it is a great program, and the new freezers and refrigerators are much thicker and you can save a lot of energy there. (P-3)

Comment: I don’t think that the Mississippi Power Company has the arrangement yet to where they will buy electricity back from a small time producer, and that needs to be in place, because that way you use the grid as the battery to store the excess off of, and I really believe – and I think we could also alter our consumption in about half, and you are talking about a 42 percent increase, and I think just energy saving and doing things that don’t really hurt your standard of living that much. (P-4)

Comment: Alternative energy, the gentleman that spoke before me I thought raised a lot of good points. But there are also a lot of studies that show that we could go now to viable alternative energy and produce, and satisfy all of our energy needs. And I agree that every energy source has its advantages and disadvantages, but I think those kinds of things should definitely be considered. (Q-4)

Comment: The other thing, also architectural standards, and there is lots of things that you could do with conservation that have not been dealt with. (Q-5)

Comment: But we all have to be responsible in our energy use. I mean, which would you rather have, cut down a little bit on your energy usage, or have Grand Gulf, and you are talking about people that maybe – I don't know how far the grid here goes, but you are talking about people that have an insatiable appetite for energy that are not going to be affected if there is a discharge that is at Grand Gulf. It is the people in Claiborne County and the people down river that are going to be affected. (Q-6)

Comment: Energy efficiency. Regarding our own shared insatiable use of energy, and I wouldn't put all the brunt on Mr. Peterson's kids. I think that we all bear some responsibility here, and we should share that responsibility. (R-8)

Comment: The merits of wind energy, and I guess there is something on NEI's site about that, but additional benefits of wind, particularly compared to nuclear plants, include that windmills would make pretty awful terrorist targets. You are not going to scare or kill many people that way, or harm them with radioisotopes, or whatever other pollutants that we are talking about, toxins. Windmills don't create tons of nuclear waste every year, and they do not require a 10-mile radius evacuation zone and plan, of which I guess the one for Grand Gulf is of questionable use and value. (R-9)

Comment: Although proponents of nuclear power will claim that this technology will reduce global warming, a substantial amount of warming is already committed to by past emissions, and nuclear power is an unrealistic alternative to global warming because of the many cheaper alternatives. The most important alternative to fossil fuel emissions is energy efficiency, and while some parts of the nation have had strong efficiency programs in place and operating for several decades, Mississippi has had nothing of significance. Since efficiency is available in massive quantity and cheaper than the cost of operating a conventional power plant of any sort (the operating cost alone, not including the capital cost of a new plant), the need for the proposed nuclear plants is a fragile assumption. (X-4)

Comment: There are other ways of providing energy that are much safer and sustainable. (AB-2)

Comment: There are too many other ways to generate energy to go this dangerous route. The U.S. needs to invest in sustainable sources of energy production – nuclear power is not a safe or economically viable means. (AF-5)

Comment: The U.S. has given little consideration and investment of alternative sources for energy production. (AF-7)

Comment: There are many alternative sources of energy; such as solar power, wind power, incineration of recyclables, or renewable sources of energy (which could all use million dollar grants). None of these produce toxic nuclear waste. These sources would also produce energy, jobs and economic benefit, but a lot less cost to the taxpayer. (AJ-15)

Comment: Whether effects on the environment would be reduced if Entergy alternatively implemented more applications of energy efficiency technologies and energy conservation rather than the development of additional nuclear power capacity at the Grand Gulf site. The Renewable Energy Policy Project has demonstrated that innovative and well-managed efficiency programs would reduce annual increases in electric growth by 61 percent, substantially reducing demand over a twenty-year period. (AL-14)

Comment: Whether effects on the environment would be reduced if Entergy alternatively implemented use of passive solar, photovoltaic, wind turbines and hybrid renewable energy systems rather than the development of additional nuclear power capacity at the Grand Gulf site. (AL-15)

Comment: Whether effects on the environment would be reduced if Entergy alternatively implemented greater use of natural gas energy rather than the development of additional nuclear power capacity at the Grand Gulf site. (AL-16)

Comment: Whether effects on the environment would be reduced if Entergy alternatively implemented broader applications of the above mentioned resources as distributed power systems rather than increased reliance on an increasingly vulnerable electrical grid system connecting any additional new power capacity at the Grand Gulf site. (AL-17)

Comment: According to Entergy, energy from the plant is not needed at this time. I believe the Site Permit should be denied because there are more viable alternatives to nuclear power and that the money spent on nuclear issues would better be spent developing these alternatives in the state. (AQ-5)

Comment: The Site Permit should be denied. Viable alternatives to nuclear power should be developed as alternatives in the state. (AR-3)

Comment: There are more viable alternatives to nuclear power and that the money would better be spent developing these alternatives in the state. (AS-3)

Comment: As a concerned citizen, I have to believe that there are more viable, environmentally friendly solutions for power production. (AT-2)

Comment: According to Entergy, energy from the plant is not needed at this time. I believe the Site Permit should be denied because there are more viable alternatives to nuclear power and that the money spent on nuclear issues would better be spent developing these alternatives in the state. (AW-6)

Comment: Although Grand Gulf has not been as notorious as say, Watts Barr in Tennessee, the nuclear option as a power source is not proving to be sustainable. (BC-3)

Comment: At a time when renewable energy is within our grasp, this proposal is a major step backward. (BI-3)

Comment: Instead of granting this permit, the government should focus on major, well-funded efforts to encourage energy conservation and development of alternative, sustainable energy such as solar and wind. (BJ-4)

Comment: It would be better to spend our resources conserving energy. I write this from a house lighted almost entirely by [fluorescent] bulbs. The house is at 58 degrees F.; I am comfortable in a watch cap, imitation fleece slippers and a heavy "miracle fabric" house coat from Sears. I drive high mileage cars. Please let me know if you want more about all the heroic things I do to help you refuse to litter the earth with the wastes from another nuclear plant. America should set an example for France and other generators of nuclear wastes. (BL-4)

Comment: I believe the Site Permit should be denied because there are more viable alternatives to nuclear power and that the money spent on nuclear issues would better be spent developing these alternatives in the state. (BN-6)

Comment: Our energy policy should be aimed at developing safe renewable sources of energy. (BP-4)

Response: *The EIS was prepared in accordance with the requirements of 10 CFR 52.18 and 10 CFR 51, which will include analyses of conservation and alternative energy sources.*

Comment: Whether effects on the environment would be reduced if Entergy alternatively implemented some or all of the above-mentioned applications as security countermeasures to any act of terrorism that would seek to target an expanded nuclear power station site for the purpose of creating widespread radiological catastrophe. (AL-18)

Response: *The EIS was prepared in accordance with the requirements of 10 CFR 52.18 and 10 CFR 51, which included an analysis in Chapter 8 of alternative energy sources. For the current application, the NRC decision will be on whether to grant the early site permit – meaning, whether this site is deemed suitable for one or more new nuclear plants. As part of its evaluation of the application, NRC staff documented in a safety evaluation report whether the site characteristics are such that adequate security plans and measures can be developed (see 10 CFR 100.21). If SERI eventually applies for a construction permit or combined operating license for the Grand Gulf site, it would have to supply a safeguards contingency plan for NRC staff review in accordance with 10 CFR 50.34.*

D.12 Operational Safety

Comment: Grand Gulf has a tremendous operating record. The plant has been here for almost 20 years, and Grand Gulf has a tremendous reputation in the industry, and that is because of operating the plant soundly, and if you were to talk to anyone that actually knows about plant operations, and they were to tell you what is one of the better plants in the industry, they would reference Grand Gulf. (A-6)

Response: *The comment is noted. The operating history of the currently operating unit was reviewed in terms of the environmental impact that may be related to the construction and operation of new nuclear facilities at the Grand Gulf early site permit site.*

Comment: SERI is asking the NRC to provide no significant impact, setting aside the Grand Gulf site. There has got to be incidents that have already happened, and I would like to incorporate by requesting that the NRC raise those issues in terms of the new comparison of the new site. And also make those documents available to the local citizens here as well. (H-2)

Response: *The early site permit process is designed to determine if the site is suitable for one or more nuclear power reactors. The operating history of the currently operating unit was reviewed in terms of the environmental impact that might be related to the construction and operation of new nuclear facilities at the Grand Gulf early site permit (ESP) site. Information regarding the environmental review process for the Grand Gulf ESP is publicly available through the Agencywide Documents Access and Management System (ADAMS) which is the U.S. Nuclear Regulatory Commission's electronic record keeping system that maintains the official records of the agency.*

Comment: Other human-induced accidents could yield similar results. Malfunctions of equipment and/or employee negligence causing accidents could be disastrous. (AP-3)

Response: *The environmental impact of postulated accidents was evaluated, and the results of this analysis are presented in Chapter 5 of the EIS.*

Comment: And primarily that stripping down as I understand is to make the construction more affordable, and this is one of the ways that the industry and the Federal agency are thinking about making it more affordable. (D-4)

Comment: Another speaker raised the issue of advanced reactor designs, and I think called them stripped-down versions of today's designs. I would look at that in another way. We have got the best engineers in the country, really globally, and in some joint partnerships with other countries, looking at new reactor designs. They are smaller, the same way that our computer mainframes that used to fit in this room now fit in a box. You have got technological advances, and you have got the use of gravity rather than pumps. So that there is less mechanical failures, or at least the chance of mechanical failures, in these designs. So it is not stripped-down and it is the using of advanced technology that like everything else in our world is getting smaller, and smaller, and smaller. (M-6)

Response: *The U.S. Nuclear Regulatory Commission (NRC) decision will be whether to grant the early site permit – meaning, whether the site is deemed suitable for one or more nuclear plants. The applicant has prepared the environmental report to address the environmental impact of construction and operation of one or more nuclear units at the Grand Gulf ESP site. There are several new reactor designs that have been certified for licensing by the NRC, and other designs are in the certification process or are being considered by the applicant. The ER does not address any particular type of nuclear plant but uses the "plant parameter envelope" to describe the operation of the possible nuclear plant and the impact from the nuclear plant's operation. At the construction and operating license stage, the actual design of the reactor(s) will be addressed.*

Appendix E

Comments on the Draft Environmental Impact Statement and Responses

Appendix E

Comments on the Draft Environmental Impact Statement and Responses

Public Comments Concerning the Draft Environmental Impact Statement

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by System Energy Resources, Inc. (SERI) for an early site permit (ESP) (SERI 2005). The proposed action requested in SERI's application is for the NRC to (1) approve a site within the existing Grand Gulf Nuclear Station boundaries as suitable for the construction and operation of a new nuclear power generating facility, and (2) issue an ESP for the proposed site identified as the Grand Gulf ESP site co-located with the existing Grand Gulf Nuclear Station. This EIS includes the NRC staff's analysis that considers and weighs the environmental impacts of constructing and operating one or more new nuclear units at the Grand Gulf ESP site or at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's recommendation to the Commission regarding the proposed action.

As part of the NRC review of the application, the NRC solicited comments from the public on a draft of this EIS (DEIS). A 75-day comment period began on April 29, 2005, when the U.S. Environmental Protection Agency (EPA) 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.

As part of the process to solicit public comments on the DEIS, the staff:

- Placed a copy of the DEIS at the Port Gibson Library
- Made the DEIS available in the NRC's Public Document Room in Rockville, Maryland
- Placed a copy of the DEIS on the NRC website at: www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1817/index.html
- Provided a copy of the DEIS to any member of the public that requested one

- Sent copies of the DEIS to certain Federal, State, and local agencies

- Published a notice of availability of the DEIS in the *Federal Register* on April 29, 2005 (70 FR 22308)

- Filed a DEIS with EPA

- Announced and held a public meeting on June 28, 2005, in Port Gibson, Mississippi to describe the results of the environmental review, answer any related questions, and take public comments.

Approximately 150 people attended this meeting and 22 attendees provided oral comments. A certified court reporter recorded these oral comments and prepared written transcripts of the meeting. The transcripts of the public meetings are part of the public record for the proposed project and were used to establish correspondence between comments contained in this volume of the EIS to oral comments received at the public meeting. In addition to the comments received at the public meeting, the NRC received 348 letters and e-mail messages with comments. The comment period closed on July 14, 2005; however, the NRC did, to the degree permitted by the schedule, consider comments submitted after the comment period ended.

The comment letters, e-mail messages, and the transcripts of the public meeting are available from the Publicly Available Records component of NRC's Agencywide Document Access and Management System (ADAMS). ADAMS is accessible at www.nrc.gov/reading-rm/adams.html, which provides access through the NRC's Public Electronic Reading Room link. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS, should contact the NRC's Public Document Room reference staff at 1-800-397-4209 or 301-415-4737, or by e-mail at pdr@nrc.gov. The NRC staff has reviewed each written comment and the transcript of the public meeting.

Disposition of Comments

This volume contains all of the comments abstracted from the comment letters and e-mail messages, provided to the staff during the comment period as well as the comments from the transcripts.

Each set of comments from a given commenter was given a unique alpha identifier (commenter ID letter), allowing each set of comments from a commenter to be traced back to the transcript, letter, or e-mail in which the comments were submitted. Each individual who made a statement during the public meeting or sent a letter or e-mail was given an additional alpha identifier D for comments received on the DEIS. Commenters whose e-mail message was part of a mass mailing campaign were assigned the letters MM instead of D. Of the 348 commenters, 305 were part of the mass mailing campaign. If the comment letters received were duplicates sent by the same person but on different days, they were labeled as duplicates, and were addressed as one commenter letter. If the letters were different, each letter was addressed individually.

After the comment period, the staff considered and dispositioned all comments received. To identify each individual comment, the NRC staff reviewed the transcript of the public meeting and each letter and e-mail received related to the DEIS. As part of the review, the staff identified statements that they believed were related to the proposed action and recorded the statements as comments. Each comment was assigned to a specific subject area, and similar comments were grouped together. Finally, responses were prepared for each comment or group of comments.

For each comment, the staff determined whether a comment:

- Related to the Grand Gulf ESP and discussed a specific environmental impact
- Related to an issue considered outside the scope of this environmental review (emergency response, alternative energy sources, cost of power, need for power, operational safety, safeguards and security related to terrorism)
- Opposed or supported nuclear power
- Opposed or supported the Grand Gulf ESP
- Discussed NRC's ESP process
- Discussed the National Environmental Policy Act of 1969 (NEPA) requirements.

This appendix presents the comments and the NRC responses to them grouped by similar issues as follows:

- Major Issues and Responses
- Technical Comments Within the Scope of this EIS
- ESP Process, NEPA Compliance, Comments Supporting or Opposing the ESP
- Comments Outside the Scope of this EIS
- References

- Commenter Reference Tables.

When the comments resulted in a change in the text of the DEIS, the corresponding response refers the reader to the appropriate section of the report where the change was made. Revisions to the text from the DEIS are indicated by vertical lines beside the text. Table E.1 provides a list of commenters identified by name, affiliation (if given), comment number, and the source of the comment. Mass mailing comments are designated MM.

Many comments addressed topics and issues that are not part of the environmental review for this proposed action. These comments included questions about the NRC's safety review, general statements of support or opposition to nuclear power, observations regarding national nuclear waste management policies, comments on the NRC regulatory process in general, and comments on NRC regulations. These comments are summarized, but detailed responses to such comments are not provided because they addressed issues that do not directly relate to the environmental effects of this proposed action and are thus outside the scope of the NEPA review of this proposed action. If appropriate, these comments were forwarded to the cognizant organization within the NRC for consideration.

Many comments specifically addressed the scope of the environmental review, analyses, and issues contained in the DEIS, including comments about potential impacts, proposed mitigation, the agency review process, and the public comment period. Detailed responses to each of these comments are provided in this appendix.

Table E-1. Individuals Providing Comments on the Draft Environmental Impact Statement

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
D-A	Amelda Arnold	Mayor	Public Meeting Transcript (ML052150003)
D-B	Ray Perryman	Jefferson County Board of Supervisors	Public Meeting Transcript (ML052150003)
D-C	David Bailey	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-D	Evan Doss	Concerned Citizen	Public Meeting Transcript (ML052150003)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
D-E	Norris McDonald	African American Environmentalist Association	Public Meeting Transcript (ML052150003)
D-F	Jim Reinsch	American Nuclear Society	Public Meeting Transcript (ML052150003)
D-G	Ruth Pullen	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-H	Paul Gunter	Nuclear Information and Resource Service	Public Meeting Transcript (ML052150003)
D-I	Brendan Hoffman	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-J	John Shorts	Claiborne County Board of Supervisors	Public Meeting Transcript (ML052150003)
D-K	George Williams	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-L	Carolyn Shanks	Entergy Mississippi	Public Meeting Transcript (ML052150003)
D-M	Phil Seaquest	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-N	Martha Ferris	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-O	Robert Butler	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-P	Michael Stuart	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-Q	Nancy Mascarella	American Nuclear Society	Public Meeting Transcript (ML052150003)
D-R	Kelly Taylor	Concerned Citizen	Public Meeting Transcript (ML052150003)
D-S	Bill Casino	Concerned Citizen	Public Meeting Transcript (ML052150003)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
D-T	Scott Peterson	Nuclear Energy Institute	Public Meeting Transcript (ML052150003)
D-U	Robert Gage	River Hills Bank	Public Meeting Transcript (ML052150003)
D-V	Doug Nasif	Main Street Program Port Gibson	Public Meeting Transcript (ML052150003)
D-W	E.R. Lutken	Concerned Citizen	E-Mail (ML052640240)
D-X	Greg Johnson	Concerned Citizen	E-Mail (ML052240044)
D-Y	Tom Lutken	Concerned Citizen	E-Mail (ML052240043)
D-Z	Elaine P. Koepp	Concerned Citizen	E-Mail (ML052640203)
D-AA	Linda C. Ferris	Concerned Citizen	E-Mail (ML052640222)
D-AB	Wendy King	Concerned Citizen	E-Mail (ML052640244)
D-AC	Robert W. Lincoln	Concerned Citizen	E-Mail (ML052640211)
D-AD	Glenda	Concerned Citizen	E-Mail (ML052640201)
D-AE	Pierre Catala	Concerned Citizen	E-Mail (ML052640321)
D-AF	Vicky Marshall-Beasley	Concerned Citizen	E-Mail (ML052640342)
D-AG	Paulette Swartzfager	Concerned Citizen	E-Mail (ML052640270)
D-AH	Stephen R. Spencer	Department of Interior	E-Mail (ML052560502)
D-AI	Wendy King	Concerned Citizen	E-Mail (ML052640274)
D-AJ	M.thibodeaux@att.net	Concerned Citizen	E-Mail (ML052560609)
D-AK	Thomas M. Pullen, Jr.	Concerned Citizen	E-Mail (ML052560513)
D-AL	M.thibodeaux@att.net	Concerned Citizen	E-Mail (ML052560477)
D-AM	Joseph P. Malherek	Public Citizen	E-Mail (ML052560498)
D-AN	Ruth Pullen	Concerned Citizen	E-Mail (ML052560508)
D-AO	Jan Hillegas	Concerned Citizen	E-Mail (ML052640286)
D-AP	George Zinke	SERI	E-Mail (ML052560489)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
D-AQ	Alexander C. Martin	Concerned Citizen	Fax (ML052560495)
D-AR	Paul Gunter	Nuclear Information and Resource Service	E-Mail (ML052560485)
D-AS	Terry Carter	Concerned Citizen	Letter (ML052220350)
D-AT	Joseph J. Mangano	Radiation and Public Health Project	Letter (ML051960026)
D-AU	Ray Perryman	Supervisor, District 5, Jefferson County	Letter (ML052130102)
D-AV	Evan Doss	Concerned Citizen	Letter (ML052130102)
D-AW	Norris McDonald	African American Environmentalist Association	Letter (ML052130102)
D-AX	Scott Peterson	Nuclear Energy Institute	Letter (ML052130102)
D-AY	Shelley Ferris	Concerned Citizen	Letter (ML052090155)
D-AZ	Heinz J. Mueller	EPA	Letter (ML052090157)
D-BA	Brendan Hoffman	Public Citizen	E-Mail (ML052560498)
D-BB	Joetta Venneman	Concerned Citizen	E-Mail (ML052640325)
D-BC	Brian Carey	Concerned Citizen	E-Mail (ML052640317)
D-BD	Jim and Virginia Wagner	Concerned Citizen	E-Mail (ML052640228)
D-BE	Lanny Stricherz	Concerned Citizen	E-Mail (ML052640235)
D-BF	Elaine Trogman	Concerned Citizen	E-Mail (ML052640328)
D-BG	Don Richardson	Concerned Citizen	E-Mail (ML052640332)
D-BH	T. K. McCranie	Concerned Citizen	E-Mail (ML052640339)
D-BI	Melanie Cordell	Concerned Citizen	E-Mail (ML052640346)
D-BJ	Irene Euchler	Concerned Citizen	E-Mail (ML052640350)
D-BK	Carol Campbell	Concerned Citizen	E-Mail (ML052640278)
D-BL	Aviv Goldsmith	Concerned Citizen	E-Mail (ML052640280)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
D-BM	Sharon Lobert	Concerned Citizen	E-Mail (ML052640287)
MM-1	Robert Lassiter and Family	Concerned Citizen	E-Mail (ML052510092)
MM-2	Jeremy Schneider	Concerned Citizen	E-Mail (ML052510092)
MM-3	Laura Juozunas	Concerned Citizen	E-Mail (ML052510092)
MM-4	Paul Dallaire	Concerned Citizen	E-Mail (ML052510092)
MM-5	Ben Demar	Concerned Citizen	E-Mail (ML052510092)
MM-6	Mark Kendall	Concerned Citizen	E-Mail (ML052510092)
MM-7	Michael McGillivray	Concerned Citizen	E-Mail (ML052510092)
MM-8	Adam Eggleston	Concerned Citizen	E-Mail (ML052510092)
MM-9	Sandra Blackburn	Concerned Citizen	E-Mail (ML052510092)
MM-10	Jennifer M Weishaar	Concerned Citizen	E-Mail (ML052510092)
MM-11	Paula Beneke	Concerned Citizen	E-Mail (ML052510092)
MM-12	Jimmie Smith	Concerned Citizen	E-Mail (ML052510092)
MM-13	Robert Schultz	Concerned Citizen	E-Mail (ML052510092)
MM-14	Scott Edmonson	Concerned Citizen	E-Mail (ML052510092)
MM-15	Rael Nidess	Concerned Citizen	E-Mail (ML052510092)
MM-16	Rachel Wolf	Concerned Citizen	E-Mail (ML052510092)
MM-17	Timothy Wampler	Concerned Citizen	E-Mail (ML052510092)
MM-18	Lecia Ferguson	Concerned Citizen	E-Mail (ML052510092)
MM-19	Tim Hibbs	Concerned Citizen	E-Mail (ML052510092)
MM-20	Gilbert Eidam	Concerned Citizen	E-Mail (ML052510092)
MM-21	Dirk Johnson	Concerned Citizen	E-Mail (ML052510092)
MM-22	Mark Reback	Concerned Citizen	E-Mail (ML052510092)
MM-23	George Robinson	Concerned Citizen	E-Mail (ML052510092)
MM-24	Audrey Burns	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-25	Jacob Lyons	Concerned Citizen	E-Mail (ML052510092)
MM-26	Andrew Neuhauser	Concerned Citizen	E-Mail (ML052510092)
MM-27	William N. Howald	Concerned Citizen	E-Mail (ML052510092)
MM-28	Michael Otto	Concerned Citizen	E-Mail (ML052510092)
MM-29	Jim Hunt	Concerned Citizen	E-Mail (ML052510092)
MM-30	Albert Valencia	Concerned Citizen	E-Mail (ML052510092)
MM-31	Dorrine Marshall	Concerned Citizen	E-Mail (ML052510092)
MM-32	Celia Santowski	Concerned Citizen	E-Mail (ML052510092)
MM-33	Kaj Dorstenia	Concerned Citizen	E-Mail (ML052510092)
MM-34	Frances Lynch	Concerned Citizen	E-Mail (ML052510092)
MM-35	George Davis	Concerned Citizen	E-Mail (ML052510092)
MM-36	Loree Rager	Concerned Citizen	E-Mail (ML052510092)
MM-37	Mario Rivera	Concerned Citizen	E-Mail (ML052510092)
MM-38	Rick LeBeau	Concerned Citizen	E-Mail (ML052510092)
MM-39	Sandra Batey	Concerned Citizen	E-Mail (ML052510092)
MM-40	Gene Burke	Concerned Citizen	E-Mail (ML052510092)
MM-41	Vicky Monroe	Concerned Citizen	E-Mail (ML052510092)
MM-42	John Kohler	Concerned Citizen	E-Mail (ML052510092)
MM-43	Larry Smith	Concerned Citizen	E-Mail (ML052510092)
MM-44	Betty Combs	Concerned Citizen	E-Mail (ML052510092)
MM-45	Jane Shelly	Concerned Citizen	E-Mail (ML052510092)
MM-46	Vernon Whitney	Concerned Citizen	E-Mail (ML052510092)
MM-47	Joe Salazar	Concerned Citizen	E-Mail (ML052510092)
MM-48	Rev. A. A. Patrick	Concerned Citizen	E-Mail (ML052510092)
MM-49	Nancy S. Lovejoy	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-50	Charles Wieland	Concerned Citizen	E-Mail (ML052510092)
MM-51	Al Buono	Concerned Citizen	E-Mail (ML052510092)
MM-52	Len Carella	Concerned Citizen	E-Mail (ML052510092)
MM-53	Dewey Keeton III	Concerned Citizen	E-Mail (ML052510092)
MM-54	Jeffrey Schultz	Concerned Citizen	E-Mail (ML052510092)
MM-55	Jeff Grayson Miller	Concerned Citizen	E-Mail (ML052510092)
MM-56	William E. Kowatch	Concerned Citizen	E-Mail (ML052510092)
MM-57	Mary Levendos	Concerned Citizen	E-Mail (ML052510092)
MM-58	Matthew McClure	Concerned Citizen	E-Mail (ML052510092)
MM-59	Chrisropher Henry	Concerned Citizen	E-Mail (ML052510092)
MM-60	Leonard & Eleanor Johnson	Concerned Citizen	E-Mail (ML052510092)
MM-61	Dian Demmer	Concerned Citizen	E-Mail (ML052510092)
MM-62	Jim Eldon	Concerned Citizen	E-Mail (ML052510092)
MM-63	Ron Rattner	Concerned Citizen	E-Mail (ML052510092)
MM-64	John Payne	Concerned Citizen	E-Mail (ML052510092)
MM-65	Brent Barnes	Concerned Citizen	E-Mail (ML052510092)
MM-66	Judy Meeker	Concerned Citizen	E-Mail (ML052510092)
MM-67	Daniel Robbins	Concerned Citizen	E-Mail (ML052510092)
MM-68	Phillip Rockey	Concerned Citizen	E-Mail (ML052510092)
MM-69	Darlene Swanson	Concerned Citizen	E-Mail (ML052510092)
MM-70	Delight Matthews	Concerned Citizen	E-Mail (ML052510092)
MM-71	Sarahjane Geraldi	Concerned Citizen	E-Mail (ML052510092)
MM-72	Seth Shulman	Concerned Citizen	E-Mail (ML052510092)
MM-73	Robert Rutkowski	Concerned Citizen	E-Mail (ML052510092)
MM-74	Okolo Thomas	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-75	Rachel Sythe	Concerned Citizen	E-Mail (ML052510092)
MM-76	Jack Runnels	Concerned Citizen	E-Mail (ML052510092)
MM-77	Kilolo Thomas	Concerned Citizen	E-Mail (ML052510092)
MM-78	Ann Thomas	Concerned Citizen	E-Mail (ML052510092)
MM-80	Jeanne Wilhelm	Concerned Citizen	E-Mail (ML052510092)
MM-81	Todd Walker	Concerned Citizen	E-Mail (ML052510092)
MM-82	Lori Albee	Concerned Citizen	E-Mail (ML052510092)
MM-83	Rev. Gordon Hills	Concerned Citizen	E-Mail (ML052510092)
MM-84	Susan Emge Milliner	Concerned Citizen	E-Mail (ML052510092)
MM-85	Rita Yribar	Concerned Citizen	E-Mail (ML052510092)
MM-86	Margerite Gamboa	Concerned Citizen	E-Mail (ML052510092)
MM-87	Robert Pancner	Concerned Citizen	E-Mail (ML052510092)
MM-88	Heidi Smith	Concerned Citizen	E-Mail (ML052510092)
MM-89	Clay Caldwell	Concerned Citizen	E-Mail (ML052510092)
MM-90	Geraldine Dimondstein	Concerned Citizen	E-Mail (ML052510092)
MM-91	Gregory Nerode	Concerned Citizen	E-Mail (ML052510092)
MM-92	Steve Latsch	Concerned Citizen	E-Mail (ML052510092)
MM-93	James Scurrah	Concerned Citizen	E-Mail (ML052510092)
MM-94	David Turnoy	Concerned Citizen	E-Mail (ML052510092)
MM-95	Leslie Dack	Concerned Citizen	E-Mail (ML052510092)
MM-96	Alice Slater	Concerned Citizen	E-Mail (ML052510092)
MM-97	Timothy Stebler	Concerned Citizen	E-Mail (ML052510092)
MM-98	John Bromer	Concerned Citizen	E-Mail (ML052510092)
MM-99	Dan Ingall	Concerned Citizen	Letter (ML052090159)
MM-100	Don Cramer	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-101	John Barfield	Concerned Citizen	E-Mail (ML052510092)
MM-102	William Rouse	Concerned Citizen	E-Mail (ML052510092)
MM-103	Micahel Cavanaugh	Concerned Citizen	E-Mail (ML052510092)
MM-104	Charles Alvarez	Concerned Citizen	E-Mail (ML052510092)
MM-105	John F. Galbraith Jr.	Concerned Citizen	E-Mail (ML052510092)
MM-106	Anoushka Habibi	Concerned Citizen	E-Mail (ML052510092)
MM-107	Sherry Redd	Concerned Citizen	E-Mail (ML052510092)
MM-108	Russ Dunham	Concerned Citizen	E-Mail (ML052510092)
MM-110	Christopher Toon	Concerned Citizen	E-Mail (ML052510092)
MM-111	Paula Bogle	Concerned Citizen	E-Mail (ML0525510092)
MM-112	John & Ann Wright	Concerned Citizen	E-Mail (ML0525510092)
MM-113	Peter Schumacher	Concerned Citizen	E-Mail (ML0525510092)
MM-114	Janet Larson	Concerned Citizen	E-Mail (ML0525510092)
MM-115	Brenda Bundy	Concerned Citizen	E-Mail (ML0525510092)
MM-116	R Palm	Concerned Citizen	E-Mail (ML0525510092)
MM-117	Derek Olfky	Concerned Citizen	E-Mail (ML0525510092)
MM-118	Dolores Tippett	Concerned Citizen	E-Mail (ML0525510092)
MM-119	Patricia McMonagle	Concerned Citizen	E-Mail (ML0525510092)
MM-120	Steve Bonzai	Concerned Citizen	E-Mail (ML0525510092)
MM-121	Gary Tenio	Concerned Citizen	E-Mail (ML0525510092)
MM-122	Christine Siever	Concerned Citizen	E-Mail (ML0525510092)
MM-124	Richard George	Concerned Citizen	E-Mail (ML052510092)
MM-125	Janet Hutto	Concerned Citizen	E-Mail (ML052510092)
MM-126	Lois Thompson	Concerned Citizen	E-Mail (ML052510092)
MM-127	A. Hembree	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-128	David H. Jones	Concerned Citizen	E-Mail (ML052510092)
MM-129	Thomas Connor	Concerned Citizen	E-Mail (ML052510092)
MM-130	Debbie Giniewicz	Concerned Citizen	E-Mail (ML052510092)
MM-131	Thomas Shodron	Concerned Citizen	E-Mail (ML052510092)
MM-132	Minelle Paloff	Concerned Citizen	E-Mail (ML052510092)
MM-135	Sara McCay &Thomas Noone	Concerned Citizen	E-Mail (ML052510092)
MM-136	Timothy Johnston	Concerned Citizen	E-Mail (ML052510092)
MM-137	Elizabeth Mozer	Concerned Citizen	E-Mail (ML052510092)
MM-138	Tracy Weatherby	Concerned Citizen	E-Mail (ML052510092)
MM-139	Judy Alter	Concerned Citizen	E-Mail (ML052510092)
MM-140	John Paul Coakley	Concerned Citizen	E-Mail (ML052510092)
MM-141	Lyn Darnall	Concerned Citizen	E-Mail (ML052510092)
MM-142	L. Young	Concerned Citizen	E-Mail (ML052510092)
MM-143	Jane Affonso	Concerned Citizen	E-Mail (ML052510092)
MM-144	Joel Isaacson	Concerned Citizen	E-Mail (ML052510092)
MM-145	Darwin Aronoff	Concerned Citizen	E-Mail (ML052510092)
MM-146	Stan Sameshima	Concerned Citizen	E-Mail (ML052510092)
MM-147	John Davis	Concerned Citizen	E-Mail (ML052510092)
MM-148	Lisa Brenneisen	Concerned Citizen	E-Mail (ML052510092)
MM-149	Constance Kosuda	Concerned Citizen	E-Mail (ML052510092)
MM-150	William P. Ellsworth - DAV	Concerned Citizen	E-Mail (ML052510092)
MM-151	Kristen Gottuso	Concerned Citizen	E-Mail (ML052510092)
MM-152	Sherryl Genone	Concerned Citizen	E-Mail (ML052510092)
MM-153	Betty Gibson	Concerned Citizen	E-Mail (ML052510092)
MM-154	Diana Bookbinder	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-155	D.A. Wagner	Concerned Citizen	E-Mail (ML052510092)
MM-156	Tammie Haugen	Concerned Citizen	E-Mail (ML052510092)
MM-157	Charlotte Thomas	Concerned Citizen	E-Mail (ML052510092)
MM-158	Don Smith	Concerned Citizen	E-Mail (ML052510092)
MM-159	Stefan Athanasiadis	Concerned Citizen	E-Mail (ML052510092)
MM-160	Kirk Atton	Concerned Citizen	E-Mail (ML052510092)
MM-161	Robert S. Lynch	Concerned Citizen	E-Mail (ML052510092)
MM-162	Bob Sutter	Concerned Citizen	E-Mail (ML052510092)
MM-164	Barbara Henderson	Concerned Citizen	E-Mail (ML052510092)
MM-165	Kathleen Sgamma	Concerned Citizen	E-Mail (ML052510092)
MM-166	Carl Abrahamson	Concerned Citizen	E-Mail (ML052510092)
MM-167	Christine Wilson	Concerned Citizen	E-Mail (ML052560477)
MM-168	Harry Baltzer	Concerned Citizen	E-Mail (ML052510092)
MM-169	Katherine Jenkins-Murphy	Concerned Citizen	E-Mail (ML052510092)
MM-170	Christine Roane	Concerned Citizen	E-Mail (ML052510092)
MM-171	Linda Howe	Concerned Citizen	E-Mail (ML052510092)
MM-172	Ava Thiesen	Concerned Citizen	E-Mail (ML052510092)
MM-173	Elizabeth Sauer	Concerned Citizen	E-Mail (ML052510092)
MM-174	Elizabeth Hammond-Pettis	Concerned Citizen	E-Mail (ML052510092)
MM-175	David A. Dorch	Concerned Citizen	E-Mail (ML052510092)
MM-176	Thomas English	Concerned Citizen	E-Mail (ML052510092)
MM-177	Dot Sulock	Concerned Citizen	E-Mail (ML052510092)
MM-178	Ryan Camp	Concerned Citizen	E-Mail (ML052510092)
MM-179	Sholey Argani	Concerned Citizen	E-Mail (ML052510092)
MM-180	Hoi Heldt	Concerned Citizen	E-Mail (ML052510092)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-181	John Riddell	Concerned Citizen	E-Mail (ML052510092)
MM-182	Dan Magee	Concerned Citizen	E-Mail (ML052510092)
MM-183	Ellen Pearce	Concerned Citizen	E-Mail (ML052510092)
MM-184	Arthur Holmgren	Concerned Citizen	E-Mail (ML052510092)
MM-185	Deborah Burns	Concerned Citizen	E-Mail (ML052510092)
MM-186	Kathleen Morris	Concerned Citizen	E-Mail (ML052510092)
MM-188	Charlie Hogue	Concerned Citizen	E-Mail (ML052510092)
MM-189	Kimberly Blum	Concerned Citizen	E-Mail (ML052510092)
MM-190	Sister Mary Fran Gebhard	Concerned Citizen	E-Mail (ML052510092)
MM-191	Richard Berghofer	Concerned Citizen	E-Mail (ML052510092)
MM-192	John Custer	Concerned Citizen	E-Mail (ML052510092)
MM-193	Chris Skoglund	Concerned Citizen	E-Mail (ML052510092)
MM-194	Ravi Grover	Concerned Citizen	E-Mail (ML052510092)
MM-195	Jesse Dye	Concerned Citizen	E-Mail (ML052510092)
MM-196	Sandra Cutter	Concerned Citizen	E-Mail (ML052510092)
MM-197	Richard Parmett	Concerned Citizen	E-Mail (ML052510092)
MM-198	Sheila Dixon	Concerned Citizen	E-Mail (ML052510092)
MM-199	Robin Kory	Concerned Citizen	E-Mail (ML052510092)
MM-200	Ginny and Bob Freeman	Concerned Citizen	E-Mail (ML052510092)
MM-201	Mary Celeste Reese	Concerned Citizen	E-Mail (ML052560477)
MM-202	Ron Peterson	Concerned Citizen	E-Mail (ML052560477)
MM-203	Mark Feldman	Concerned Citizen	E-Mail (ML052560477)
MM-204	Esther Davis	Concerned Citizen	E-Mail (ML052510092)
MM-205	Charles Connors	Concerned Citizen	E-Mail (ML052560477)
MM-206	Clyde R. Chamberlain	Concerned Citizen	E-Mail (ML052560477)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-207	Jessica Shupe	Concerned Citizen	E-Mail (ML052560477)
MM-209	Judy Allen	Concerned Citizen	E-Mail (ML052560477)
MM-210	Megan Ahearn	Concerned Citizen	E-Mail (ML052560477)
MM-211	Nick Mastro	Concerned Citizen	E-Mail (ML052560477)
MM-212	Jaime Rodriguez	Concerned Citizen	E-Mail (ML052560477)
MM-213	Mailie La Zarr	Concerned Citizen	E-Mail (ML052560477)
MM-214	Bruce Jenkins	Concerned Citizen	E-Mail (ML052560477)
MM-215	Linda Kirk	Concerned Citizen	E-Mail (ML052560477)
MM-216	Jason Slipp	Concerned Citizen	E-Mail (ML052560477)
MM-217	Michele Zalopany	Concerned Citizen	E-Mail (ML052560477)
MM-218	Harvey Schaktman	Concerned Citizen	E-Mail (ML052560477)
MM-219	Don Mutchler	Concerned Citizen	E-Mail (ML052560477)
MM-220	Erin James	Concerned Citizen	E-Mail (ML052560477)
MM-221	William T. Smith	Concerned Citizen	E-Mail (ML052560477)
MM-222	Jason Straub	Concerned Citizen	E-Mail (ML052560477)
MM-223	Linda Speel	Concerned Citizen	E-Mail (ML052560477)
MM-224	Joseph Dangelo	Concerned Citizen	E-Mail (ML052560477)
MM-225	Jane Childers	Concerned Citizen	E-Mail (ML052560477)
MM-226	Nici Edwards	Concerned Citizen	E-Mail (ML052560477)
MM-227	Sabrina Choi	Concerned Citizen	E-Mail (ML052560477)
MM-228	Edward Schaechtel	Concerned Citizen	E-Mail (ML052560477)
MM-229	Cliff Staebler	Concerned Citizen	E-Mail (ML052560477)
MM-230	Azel Beckner	Concerned Citizen	E-Mail (ML052560477)
MM-231	Jennifer Worrell	Concerned Citizen	E-Mail (ML052560477)
MM-232	Paul Stein	Concerned Citizen	E-Mail (ML052560477)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-233	Country Maron	Concerned Citizen	E-Mail (ML052560477)
MM-234	Mha Atma S Khalsa	Concerned Citizen	E-Mail (ML052560477)
MM-235	Kent Minault	Concerned Citizen	E-Mail (ML052560477)
MM-236	Vera Cousins	Concerned Citizen	E-Mail (ML052560477)
MM-237	Linda Ferris	Concerned Citizen	E-Mail (ML052560477)
MM-238	Sue Lundin	Concerned Citizen	E-Mail (ML052560477)
MM-240	Sarah Lanzman	Concerned Citizen	E-Mail (ML052560477)
MM-241	Catherine Marciniak	Concerned Citizen	E-Mail (ML052560477)
MM-242	Arthur Dronzkowski	Concerned Citizen	E-Mail (ML052560477)
MM-243	Aurora Hunter	Concerned Citizen	E-Mail (ML052560477)
MM-244	Cheryl Hines-Dronzkowski	Concerned Citizen	E-Mail (ML052560477)
MM-245	Nicholle Wedding	Concerned Citizen	E-Mail (ML052560477)
MM-246	Misha Fredericks	Concerned Citizen	E-Mail (ML052560477)
MM-247	Bruce Arkwright, Jr.	Concerned Citizen	E-Mail (ML052560477)
MM-248	John W Winningham	Concerned Citizen	E-Mail (ML052560477)
MM-249	Colette Wedding	Concerned Citizen	E-Mail (ML052560477)
MM-250	Eileen Chieco	Concerned Citizen	E-Mail (ML052560477)
MM-251	Pat Dressler	Concerned Citizen	E-Mail (ML052510092)
MM-252	Justin Bernstein	Concerned Citizen	E-Mail (ML052560477)
MM-253	Danielle Cantin	Concerned Citizen	E-Mail (ML052560477)
MM-254	S. H.	Concerned Citizen	E-Mail (ML052560477)
MM-255	John Lischalk	Concerned Citizen	E-Mail (ML052560477)
MM-256	Robert Critser	Concerned Citizen	E-Mail (ML052560477)
MM-257	Mike Ewall	Concerned Citizen	E-Mail (ML052560477)
MM-258	Paxus Calta	Concerned Citizen	E-Mail (ML052560477)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-259	Shelly Stern	Concerned Citizen	E-Mail (ML052560477)
MM-260	S.M. Dixon	Concerned Citizen	E-Mail (ML052560477)
MM-261	Rashid El Amin	Concerned Citizen	E-Mail (ML052560477)
MM-263	Sharon Kansas	Concerned Citizen	E-Mail (ML052560477)
MM-264	Kathy Galligan	Concerned Citizen	E-Mail (ML052560477)
MM-265	Renata Dobryn	Concerned Citizen	E-Mail (ML052560477)
MM-266	Mary Perner	Concerned Citizen	E-Mail (ML052560477)
MM-267	James Causey	Concerned Citizen	E-Mail (ML052560477)
MM-268	Marilyn Spivey	Concerned Citizen	E-Mail (ML052560477)
MM-269	Charlie Brenner	Concerned Citizen	E-Mail (ML052560477)
MM-271	Robert Harrison	Concerned Citizen	E-Mail (ML052560477)
MM-272	Patricia Aguirre	Concerned Citizen	E-Mail (ML052560477)
MM-273	Ellen Jamieson	Concerned Citizen	E-Mail (ML052560477)
MM-274	Stephen Jacobs	Concerned Citizen	E-Mail (ML052560477)
MM-275	Merry McLoryd	Concerned Citizen	E-Mail (ML052560477)
MM-276	Robert Wilson	Concerned Citizen	E-Mail (ML052560477)
MM-277	Martha Ferris	Concerned Citizen	E-Mail (ML052560477)
MM-278	Noreen Kenny	Concerned Citizen	E-Mail (ML052560477)
MM-279	Sylvia Goldberg	Concerned Citizen	E-Mail (ML052560477)
MM-280	Seamus Allman	Concerned Citizen	E-Mail (ML052560477)
MM-281	Richard Gilman	Concerned Citizen	E-Mail (ML052560477)
MM-282	Connie Schuett	Concerned Citizen	E-Mail (ML052560477)
MM-283	Sandra Lindberg	Concerned Citizen	E-Mail (ML052560477)
MM-285	Mary Lewis	Concerned Citizen	E-Mail (ML052560477)
MM-286	Angela McComb	Concerned Citizen	E-Mail (ML052560477)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-287	Kirk Butler	Concerned Citizen	E-Mail (ML052560477)
MM-288	Brian Lutenegger	Concerned Citizen	E-Mail (ML052560477)
MM-289	Judi Misale	Concerned Citizen	E-Mail (ML052560477)
MM-290	Gregory Nerode	Concerned Citizen	E-Mail (ML052560477)
MM-291	Sharon Kansas	Concerned Citizen	E-Mail (ML052560477)
MM-292	Christine Roane	Concerned Citizen	E-Mail (ML052560477)
MM-293	William N. Howald	Concerned Citizen	E-Mail (ML052560477)
MM-294	David Sagers	Concerned Citizen	E-Mail (ML052560477)
MM-295	Brigitte Leciejewski	Concerned Citizen	E-Mail (ML052560477)
MM-296	Linda Ferris	Concerned Citizen	E-Mail (ML052560477)
MM-297	Karen Mitchell	Concerned Citizen	E-Mail (ML052560477)
MM-298	Sharon Callahan	Concerned Citizen	E-Mail (ML052560477)
MM-299	Kenyon Karl	Concerned Citizen	E-Mail (ML052560477)
MM-300	Thomas Markham	Concerned Citizen	E-Mail (ML052560477)
MM-301	Robert Hardee	Concerned Citizen	E-Mail (ML052560477)
MM-302	Georgia M. Pawlowski	Concerned Citizen	E-Mail (ML052560477)
MM-303	Jacob Lyons	Concerned Citizen	E-Mail (ML052560477)
MM-304	Dean Foss	Concerned Citizen	E-Mail (ML052560477)
MM-305	Joe Wright	Concerned Citizen	E-Mail (ML052560477)
MM-306	Jacqueline Luck	Concerned Citizen	E-Mail (ML052560477)
MM-307	Katherine Jenkins-Murphy	Concerned Citizen	E-Mail (ML052560477)
MM-308	Betty Gibson	Concerned Citizen	E-Mail (ML052560477)
MM-309	Amy Harlib	Concerned Citizen	E-Mail (ML052560477)
MM-310	Jane Shelly	Concerned Citizen	E-Mail (ML052560477)
MM-311	D.Jackie Handel	Concerned Citizen	E-Mail (ML052640294)

Table E-1. (contd)

Commenter ID	Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #
MM-312	Sandra Batey	Concerned Citizen	E-Mail (ML052560477)
MM-313	Nici Edwards	Concerned Citizen	E-Mail (ML052560477)
MM-314	Christopher Toon	Concerned Citizen	E-Mail (ML052640291)
MM-315	JoAnn Witt	Concerned Citizen	E-Mail (ML052560477)
MM-316	Ruth Ann Dunn	Concerned Citizen	E-Mail (ML052560477)
MM-317	Julia Burnette	Concerned Citizen	E-Mail (ML052560477)

Comments and Responses

Table E-2 presents the categories in which the comments were grouped and the commenters having comments in that category.

The comments that are considered in the evaluation of the environmental impact in this EIS are summarized in the following pages. Parenthetical notations after each comment refer to the commenter's ID letters and the comment number. Comments can be tracked to the commenter and the source document through the ID letter and comment number listed in Table E-1.

Table E-2. Comments Grouped by Comment Category

Comment Category	Commenter ID
Aging Management	AC, AT
Air Quality	E
Alternatives and Alternative Sites	A, AB, AC, AF, AG, AJ, AM, AN, BB, BD, BF, BG, BH, BJ, BL, C, G, I, P, W, Y, MM
Concerns Related to the ESP process	AM, AN, AO, AS
Cost of Power	AC, I, M
Cultural Resources	AZ
Cumulative Impacts	AP, AZ

Table E-2. (contd)

Comment Category	Commenter ID
Ecology	AH, AM, AP, AZ
Editorial	AP, AZ
Emergency Preparedness	AN, AO, AU, AY, AZ, B, N, W, X, Y
Energy Generation Ownership	AD
Environmental Justice	AM, AN, AO, AR, AT, AV, AW, AZ, BB, BD, BF, BG, BH, BI, BJ, BK, BL, D, E, G, H, X, MM
Groundwater Quality	AZ
Human Health - Nonradiological Impacts	AM
Human Health – Radiological Impacts	AA, AM, AP, AR, AS, AT, AZ, N
Land Use	AR
Need for Power	AM, BF
NEPA Compliance	AM, AN, AP, AZ
Opposition to NRC's ESP Process	AE, AI, AK, AN, AQ, AR, AS, BL, G, H, I
Opposition to Nuclear Power	AK
Opposition to the Licensee or Licensee's Application	AA, AB, AC, AF, AG, AI, AJ, AK, AL, AM, AQ, AR, AV, AY, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, N, O, W, X, Y, Z, MM
Postulated Accidents	AF, AM, AN, AZ, BJ, X
Safeguards and Security	AC, AI, AK, AM, AN, BB, BC, BD, BG, BH, BI, BJ, BL, BM, I, R, W, MM
Safety Review for ESP	AN, AO
Socioeconomics	AM, AQ, AR, AS, AV, AW, AZ, H, BB, BD, BG, BH, BI, BJ, BL, BM, D, MM
Support for NRC's ESP Process	AX, C, K, Q, T
Support for the Licensee or Licensee's Application	AU, AW, AX, A, B, E, F, J, L, M, R, S, T, U, V
Surface Water Use and Quality	AF, AH, AM, AZ
Threatened or Endangered Species	AH, AP
Uranium Fuel Cycle and Waste Management	AA, AC, AF, AJ, AK, AM, AN, AP, AR, AZ, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, H, N, P, S, W, X, Y, MM

Subject: Aging Management

Comment: The Grand Gulf reactor first achieved criticality - and produced radioactive fission products - on August 18, 1982, and many mechanical parts of the reactor are aging. (AT-7)

Response: *The current application is for an early site permit for a postulated new reactor. It does not contain detailed design information and is not directly related to the existing reactor at the Grand Gulf site. Therefore, consideration of reactor aging is outside of the scope of this environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Reactors in the U.S. are also deteriorating with age and inadequate oversight by the Nuclear Regulatory Commission provides further reason for concern. Just three years ago, for example, a nuclear reactor in Ohio came within one-fifth of an inch of stainless steel from a rupture that would have vented radioactive steam into the reactor's containment building and could have led to a meltdown. (AC-6)

Response: *The current application is for an early site permit for a postulated new reactor. It does not contain detailed design information and is not directly related to the existing reactor at the Grand Gulf site. Therefore, consideration of reactor aging is outside the scope of this environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Since 1999, Grand Gulf has operated 96% of the time (capacity factor), up from 83%/6-in previous years, even though the reactor is aging. (AT-9)

Response: *The current application is for an early site permit for a postulated new reactor. It does not contain detailed design information and is not directly related to the existing reactor at the Grand Gulf site. Therefore, consideration of reactor capacity factors and aging is outside of the scope of this environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Subject: Air Quality

Comment: Two quick points, one is air pollution that was mentioned in the report. It says that this is an attainment area, and maybe that's according to EPA standards. I would hope that NRC would review that because I saw the air today. And maybe they should consider the African American Environmentalist Association standards, and that is, if you can see the air, it’s not good to breathe. I could see the air today, so you might want to consider using our standard. (E-2)

Response: *This comment provides no new information for additional analysis. This comment did not result in a change to the environmental impact statement.*

Subject: Alternatives and Alternative Sites

Comment: You also need to look at all the alternative energy sources. For example, in the examination of alternative energy, they discussed solar, and I talked about setting up a solar array at Grand Gulf. (G-5)

Response: *Alternative energy sources are discussed in Section 8.2 of the environmental impact statement. Solar power is discussed in Section 8.2.3.3 of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Alternative Energy Sources: Regarding these NEPA requirements, of particular concern to Public Citizen is the deficient consideration of renewable energy sources in the draft EIS, which the staff considers to be unreasonable (§ 8.2.3). While the evaluation does consider renewable energy sources as an alternative, it does not give a fair and thorough review of the potential of clean, sustainable energy, and it relies partly on evaluations performed by SERI (see EIS, § 8.2.3). The evaluation of alternatives to the proposed action in the EIS fails to achieve the requirements of 40 CFR 1502.14, which compels agencies, inter alia, to "devote substantial treatment to each alternative considered in detail." While the draft EIS gives fair attention to alternative sites for a new reactor, it gives only scant attention to renewable energy alternatives. The draft EIS overstates the impacts of clean energy alternatives and understates the impacts of nuclear power, wrongly concluding renewable energy sources would not be superior to a new nuclear unit at the GGNS "from an environmental perspective" (EIS, § 8.2.5). In particular, the draft EIS improperly evaluates the energy potential of wind and solar as alternatives to new nuclear units at the GGNS by restricting the geographic area in which those sources are contemplated to the immediate region around the GGNS. But SERI intends to operate its new nuclear plant as a merchant facility, meaning that the electricity that it would produce would be sold into the competitive marketplace and often exported from the immediate region to wherever it could be purchased at the highest price (EIS, pg. 8-4). Therefore, it is illogical to restrict the analysis of energy alternatives to those which could be constructed at or near the GGNS. Electricity can be transported over great distances, and the evaluation of renewable energy alternatives should reflect this fact. (AM-7)

Response: *An environmental report is a document submitted to the Commission by an applicant to aid the Commission in complying with Section 102(2) of the National Environmental Policy Act of 1969 (10 CFR 51.14). In complying with the National Environmental Policy Act of 1969, the Commission develops an independent environmental analysis (10 CFR 51.70(b),* *51.90). U.S. Nuclear Regulatory Commission regulations implementing the National Environmental Policy Act of 1969 provide for the consideration of alternatives (10 CFR 51.71(d)). U.S. Nuclear Regulatory Commission regulations (10 CFR 51.10(a)) also provide that the Commission will take account of the regulations of the Council on Environmental Quality published November 29, 1978 (43 FR 55978-56007) voluntarily, subject to certain conditions. While the Council on Environmental Quality regulations are not binding on the U.S. Nuclear Regulatory Commission when the agency has not expressly adopted them, they are entitled to considerable deference. See Limerick Ecology Action, Inc. v. NRC, 869 F.2d 719, 725, 743 (3d Cir. 1989). The Council on Environmental Quality advises that when there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in an environmental impact statement (46 FR 18027; March 23, 1981). It would not be practical for an environmental impact statement prepared in conjunction with an application for an early site permit to analyze all potential sites for wind and solar energy development in the applicant's region of interest.*

As a result of its independent analysis, the staff concluded that the analysis of energy alternatives in Section 8.2 of the environmental impact statement does consider a reasonable set of alternatives. Section 8.2.5 of the environmental impact statement states that if significant changes in generation technology or environmental impacts associated with particular generation technologies should occur and an early site permit holder seeks a construction permit or combined license to build a new nuclear generating plant at an early site permit location, the staff would verify the analysis of energy alternatives conducted at the early site permit stage. Section 8.2.1 of the environmental impact statement states that the staff would consider energy alternatives not requiring new generating capacity if an early site permit holder seeks a construction permit or combined license to build a new nuclear generating plant at an early site permit location if new and significant information becomes available. This comment did not result in a change to the environmental impact statement.

Comment: The other concern I have is that all the alternatives were provided by Entergy, all the alternative sites. And I think if you're going to be looking at alternatives, not only alternative energy, but alternative sites, and you're going to be doing it in the best interest of the country and the people of Mississippi, then you need to look at all alternative sites, not just the ones that would most benefit Entergy. (G-4)

***Response:** The Council on Environmental Quality advises that when there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in an environmental impact statement (46 FR 18027; March 23, 1981). The staff determined that the proposed site and the three alternative sites analyzed in detail in Chapter 8 of the environmental impact statement* *were selected with reasonable criteria and constituted a reasonable number of sites for consideration and analysis. This comment did not result in a change to the environmental impact statement and conforms with the staff's review guidance (NRC 2000).*

Comment: It's very important that we not only look at restarting building nuclear power plants, but look at other alternative fuels, and how we can best become self-sufficient. It's to the U.S.'s advantage to look at all alternatives and create a self-sufficiency for the U.S. to ensure that we're not dependent upon the oil and be stopped again like we were back in the early 70s. (C-2)

Response: *Energy alternatives are discussed in Section 8.2 of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: We are looking for alternate sources of fueling, and nuclear energy is one of the cleanest, cheapest forms of energy around. Now, I don't know, you know, if any of you have filled your cars or anything up lately. I filled my up today, it was like $38. You know, that's a lot of money. (A-2)

Comment: I urge you to deny the application for a nuclear site permit and to close down the current plant. There are other energy alternatives. (W-5)

Comment: Nuclear Power is Unnecessary: We can meet our future electricity needs and reduce global warming pollution without increasing our reliance on nuclear energy. (AC-3)

Response: *Energy alternatives are discussed in Section 8.2 of the environmental impact statement. These comments did not result in a change to the environmental impact statement.*

Comment: I would like to mention that it's not nuclear or solar or wind or hydro or geothermal or biomass, it's a combination of all of these non-emitting pollution free sources that we need to secure our energy future. (P-1)

Response: *Section 8.2.4 of the environmental impact statement discusses the use of a combination of energy sources as an alternative to the construction of new nuclear generating units at the Grand Gulf site. The staff concluded in Section 8.2.5 that none of the viable energy alternatives, including a combination of energy alternatives and conservation, are obviously superior to construction of a new base load nuclear power generation plant. Federal energy policy is the purview of the Congress and the President. As the Energy Policy Act of 2005 (P.L. 109-58) affirmed, energy policy makers believe that nuclear power is one of the viable means to provide electrical energy supply to meet public demands. The U.S. Nuclear Regulatory Commission is not the promoter of nuclear power. It is the safety regulator of nuclear power plants. The U.S. Nuclear Regulatory Commission established a licensing* *framework under the direction of and granted by the authority of the Congress to review requests for permits and licenses to use radioactive material. This comment did not result in a change to the environmental impact statement.*

Comment: I don't think it's appropriate to let Entergy decide exactly what the goal of this project is going to be. (I-3)

Response: *System Energy Resources, Inc. initiated the review process when it submitted its early site permit application to the U.S. Nuclear Regulatory Commission. Once the application was submitted, the process to review the application was conducted according to U.S. Nuclear Regulatory Commission regulations and procedures. The U.S. Court of Appeals for the District of Columbia Circuit and the Commission have recognized that due to the nature of a Federal action such as U.S. Nuclear Regulatory Commission licensing, where the project is sponsored by a private applicant and not the Government, the licensing agency's role is limited. See Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 197-99 (D.C. Cir. 1991), cert. denied, 502 U.S. 994 (1991); Hydro Res., Inc. (P.O. Box 15910, Rio Rancho, NM 87174), CLI-01-04, 53 NRC 31, 55 (2001). In reviewing a license application filed by a private applicant, an agency acts appropriately to "accord substantial weight to the preferences of the applicant and/or sponsor[,]" and "take into account the 'economic goals of the project's sponsor." See Busey, 938 F.2d at 197; Hydro, CLI-01-04, 53 NRC at 55 (internal citations omitted). As a consequence, an alternative is reasonable, such that it must be evaluated pursuant to Section 102(2)(E) of the National Environmental Policy Act of 1969, only if it will achieve the goals of the project applicant. See Busey, 938 F.2d at 197, 199; Hydro, CLI-01-4, 53 NRC at 55. This comment did not result in a change to the environmental impact statement.*

Comment: How about all that energy flowing past day and night right in front of the plant? Could we get some of that without damming the river? (Y-4)

Response: *The staff is not aware of any feasible base load-generating technologies to harness the power of Mississippi River water without damming the river or installing structures in the river that could represent an obstruction to river traffic. This comment did not result in a change to the environmental impact statement.*

Comment: Another example: (page 8-20) "neither type of solar electricity system would fit the land area footprint available at the Grand Gulf ESP site." For example, while SERI evaluated the solar option at Grand Gulf, it did not evaluate it at the alternative sites or other possible sites. Solar may not be an option at the GGNS site itself, but because it can be decentralized (a definite advantage in preventing regional blackouts), it should not be eliminated as a possibility. Again, the bias was towards SERI/Entergy and the selections SERI made. A more thorough analysis of possible alternatives needs to be made and certainly the need for more power should be demonstrated. Mississippi certainly does not need more power and therefore its citizenry should not be subjected to the dangers of nuclear power. (AN-12)

Response: *Under U.S. Nuclear Regulatory Commission's regulations (10 CFR 52.18), an assessment of the benefits of the proposed action, such as the need for power, need not be evaluated in conjunction with the review of an early site permit application. The staff's evaluation of solar power as an alternative to new nuclear construction at the Grand Gulf site is in Section 8.2.3.3 of the environmental impact statement. The Council on Environmental Quality advises that, when there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in an environmental impact statement (46 FR 18027; March 23, 1981). It would not be practical for an environmental impact statement prepared in conjunction with an application for an early site permit to analyze all potential sites for solar energy development in the applicant's region of interest.*

The U.S. Nuclear Regulatory Commission's mission is to regulate the nation's civilian use of by-product, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. Any Commission decision on the application for an early site permit by System Energy Resources, Inc. would be consistent with this mission. The U.S. Court of Appeals for the District of Columbia Circuit and the Commission have recognized that due to the nature of a Federal action such as U.S. Nuclear Regulatory Commission licensing, where the project is sponsored by a private applicant and not the Government, the licensing agency's role is limited. See Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 197-99 (D.C. Cir. 1991), cert. denied, 502 U.S. 994 (1991); Hydro Res., Inc. (P.O. Box 15910, Rio Rancho, NM 87174), CLI-01-04, 53 NRC 31, 55 (2001). In reviewing a license application filed by a private applicant, an agency acts appropriately to "accord substantial weight to the preferences of the applicant and/or sponsor" and "takes into account the 'economic goals of the project's sponsor.'" See Busey, 938 F.2d at 197; Hydro, CLI-01-04, 53 NRC at 55 (internal citations omitted). As a consequence, an alternative is reasonable, such that it must be evaluated pursuant to Section 102(2)(E) of the National Environmental Policy Act of 1969, only if it will achieve the goals of the project applicant. See Busey, 938 F.2d at 197, 199; Hydro, CLI-01-4, 53 NRC at 55. This comment did not result in a change to the environmental impact statement.

Comment: Their presence will never encourage their owners, such as Entergy or Edison Electric, to put energy conservation and renewable energy technologies to greater use, as long as those owners continue to paint these so-called "clean" nuclear power plants as more environmentally friendly than their predecessors. It is time for the NRC and the Department of

Energy to finally bury this poisonous, dirty, environmentally unfriendly energy source, and work towards renewable energy sources and energy efficiency as truly environmentally sound energy sources. (AB-2)

Comment: Instead we can significantly reduce global warming pollution and save consumers money by increasing energy efficiency and shifting to clean renewable sources of energy. (AC-2)

Comment: So, to summarize, let's not build more nuclear power plants or expand existing plants. Let's get on the sustainable bandwagon, as European countries are - let's develop safe forms of energy, such as solar and wind. All the energy in the world ain't gonna help us if it's radioactive. (AF-5)

Comment: The solution to the US energy problem is to reduce consumption and to rely on renewable energy (such as wind and solar energy). The dangers of nuclear facilities (no matter how minimal) are simply unacceptable and unnecessary. The specific building of nuclear facilities in the South--where solar and wind resources are abundant--is particularly ridiculous. (AG-2)

Comment: Also of concern is the deficient consideration of renewable energy sources in the draft EIS. While the evaluation does consider renewable energy sources as an alternative, it (does) not give a fair and thorough review of the potential of clean, sustainable energy, and it relies partly on evaluations performed by SERI. The draft EIS overstates the impacts of clean energy alternatives and understates the impacts of nuclear power, wrongly concluding renewable energy sources would not be superior to a new nuclear unit at Grand Gulf "from an environmental perspective." Further, by considering only renewable energy deployment physically at the Grand Gulf site, it unfairly limits the scope of the review and the potential for renewable energy technologies to provide a meaningful contribution to the electric supply. Conservation and efficiency improvements are also unfairly dismissed. (BB-4, BG-5, BJ-6, BL-5, MM-5)

Comment: We are also concerned by the deficient consideration of renewable energy sources in the draft EIS. While the evaluation does consider renewable energy sources as an alternative, it (does) not give a fair and thorough review of the potential of clean, sustainable energy, and it relies partly on evaluations performed by SERI. The draft EIS overstates the impacts of clean energy alternatives and understates the impacts of nuclear power, wrongly concluding renewable energy sources would not be superior to a new nuclear unit at Grand Gulf "from an environmental perspective." By considering only renewable energy deployment physically at the Grand Gulf site, it unfairly limits the scope of the review and the potential for renewable energy technologies to provide a meaningful contribution to the electric supply. Conservation and efficiency improvements are also unfairly dismissed. (BD-5)

Comment: The DEIR irresponsibly dismisses getting energy instead from renewable sources & conservation. (BF-3)

Comment: Also of concern is the deficient consideration of renewable energy sources in the draft EIS. While the evaluation does consider renewable energy sources as an alternative, my understanding is that it does not present a fair and thorough review of the potential of clean, sustainable energy. Instead, it relies partly on evaluations performed by SERI. Furthermore, the draft EIS overstates the impacts of clean energy alternatives and understates the impacts of nuclear power, wrongly concluding renewable energy sources would not be superior to a new nuclear unit at Grand Gulf "from an environmental perspective." By considering only renewable energy deployment physically at the Grand Gulf site, the draft EIS unfairly limits the scope of the review and the potential for renewable energy technologies to provide a meaningful contribution to the electric supply. Conservation and efficiency improvements are dismissed in a manner that appears less than fair. (BH-5)

Response: *Various renewable energy alternatives are discussed in Section 8.2.3 of the environmental impact statement. The staff determined that none of the renewable technologies would be feasible alternatives to replace a new nuclear base load power plant. Energy alternatives not requiring new generating capacity would be further evaluated in the future if new and significant information becomes available and if System Energy Resources, Inc. were granted an early site permit and elects to seek a construction permit or combined license for a new nuclear plant at the early site permit site. These comments did not result in a change to the environmental impact statement.*

Comment: There are clean alternatives, there are cheaper alternatives, like wind power, for example. Probably not here in Mississippi, although options for biomass exist down here. But there are alternatives that are being dismissed out of hand that really provide honest options for meeting our energy needs. Conservation and efficiency can go extremely far in meeting our needs. (I-4)

Response: *The U.S. Nuclear Regulatory Commission does not establish public policy regarding electric power supply and demand alternatives and does not promote the use of nuclear power as a preferred energy alternative. In addition, the U.S. Nuclear Regulatory Commission does not regulate alternatives to producing electricity that do not involve nuclear power. The U.S. Nuclear Regulatory Commission does evaluate energy alternatives as part of its environmental review for an application for a construction permit or a combined license. Further, if an applicant elected to include it in its early site permit application as System Energy Resources, Inc. did, then the U.S. Nuclear Regulatory Commission would evaluate that information as part of the early site permit environmental review.*

Uncontrolled greenhouse emissions to the environment are attributed to the consumption of fossil fuels whether for industrial use, such as an energy-intensive manufacturing facility, or personal use, such as for the automobile. Nuclear power plants may not emit greenhouse gases in large quantities, however, that only applies to the operation of the facility for the production of electricity. Fossil fuels are often used as part of the infrastructure needed to operate a nuclear power facility, notably, for the manufacture of the fuel that is used in the facility. Greenhouse gas emissions from vehicle use to, from, and at the plant would be offset by vehicle use by personnel for any other type of power generation. It is an important factor that the amount of greenhouse gas emissions produced in the energy sector is not trivial; this is considered by energy policy decisionmakers elsewhere in the government.

Various renewable energy alternatives are discussed in Section 8.2.3 of the environmental impact statement. Wind power is discussed in Section 8.2.3.2 and biomass-derived fuels are discussed in Section 8.2.3.8 of the environmental impact statement. The staff determined that these technologies do not provide a feasible alternative to replace a new nuclear baseload power plant. Energy alternatives not requiring new generating capacity would be further evaluated in the future if new and significant information becomes available and System Energy Resources, Inc. were granted an early site permit and elected to seek a construction permit or combined license for a new nuclear plant at the early site permit site.

With respect to conservation and efficiency, in Sections 8.2.1 and 8.2.4, the staff discussed conservation and demand-side management programs as alternatives that would not require new generating capacity and included conservation and demand-side management programs as part of a potentially cost-effective energy alternative that would involve a combination of energy alternatives. This comment did not result in a change to the environmental impact statement.

Comment: Wind energy can replace the anticipated output for the new nuke at Grand Gulf without the environmental 10,000 years of waste. NRC has to the public's interest and wants to condemn the poorest delta region to the highest operating cost facility. What the commission must consider is total life cycle costs. (AJ-1)

Response: *Various renewable energy alternatives are discussed in Section 8.2.3 of the environmental impact statement. Wind power is discussed in Section 8.2.3.2 of the environmental impact statement. The staff determined that wind technology would not be a feasible alternative to replace a new nuclear base load power plant. In Section 6.1.1.6 of the environmental impact statement, the staff concluded that the radioactive waste impacts of constructing and operating new nuclear power plants would be small. This comment did not result in a change to the environmental impact statement.*

Subject: Concerns Related to the ESP Process

Comment: The entire ESP process is extremely flawed and biased towards the nuclear industry. Of particular concern is the vagueness of the parameters used in determining the staff's recommendation for the ESP. While the DEIS pages 1-7 state that the ESP process "allows for early resolution of many safety and environmental issues that may be identified for the ESP site," appendix J lists 16 pages of assumptions made by SERI in its report to the NRC. I don't believe that any definitive decision can be made when the data is based on so many assumptions and estimates. Further, the PPE does not require selection of a plant design, but only that the limits in which SERI select a design in the future be set. Again and again in the DEIS, the fact that no plant design has been selected hinders the staff's ability to make a determination. For example, page 2-23 states: "After a plant design has been selected, additional site exploration, laboratory testing, and geotechnical analyses will be performed"…; page 2-30 states that "As no specific design has been selected, water treatment and waste water designs are currently unknown." This has resulted in a DEIS that repeatedly states that SERI did not provide enough information or select a plant design and therefore further assessment will have to be done at the CP or COL stage. Just one example- "However, at the CP or COL stage, SERI would need to demonstrate that the Catahoula formation could support the additional groundwater withdrawals"(page 4-6) and that "Prior to issuance of a COL, the applicant would be required to implement a subsurface characterization and groundwater monitoring program…." (page 2-26). On page 3-6: "the staff identified when and how assumptions and bounding values limit its conclusions on the environmental impacts to a particular resource." If further assessment or information are continually needed then the ESP process is obviously a waste of NRC staff time and taxpayer dollars. Despite the fact that the NRC is in large part a fee based agency, government subsidies to the utility make this entire process a waste of taxpayer dollars. Page 10-7 states: "If granted, the ESP will not authorize any activities by SERI that would have an environmental impact." What is the point of requiring an environmental impact statement for an ESP that won't authorize activities with an environmental impact? Again, the process is flawed and needs to be changed. More decisions and information should be required of the applicant before the ESP process can go forward. In addition, the Draft Safety Evaluation Report (DSER 4/2005) (not included in the DEIS) states that "the staff is requesting additional information from the applicant regarding certain matters" which it refers to as "open items." The document states that "Completion of the staff's final safety evaluation report (FSER) according to the current schedule will depend on the applicant's timely submission of information sufficient to resolve each open item and allow the staff to review that information before issuance of the FSER." Again, more incomplete information has been provided by SERI. (AN-1)

Response: *As stated in the U.S. Nuclear Regulatory Commission's early site permit Review Standard RS-002 (NRC 2004a), the purpose of the early site permit regulations in Part 52 is, in part, to make it possible to resolve safety and environmental issues related to siting before an* *applicant needs to make large commitments of resources. Having obtained an early site permit, an applicant for a construction permit or combined license for a nuclear power plant or plants can then reference it in a construction permit or combined license application. In accordance with 10 CFR 52.39, site-related issues resolved at the early site permit stage will be treated as resolved at the construction permit or combined license stage unless a contention is admitted that a reactor does not fit within one or more of the site parameters in the early site permit, a petition alleges that the site is not in compliance with the early site permit, or a petition alleges that the terms and conditions of the early site permit should be modified. Issues not resolved at the early site permit stage will be evaluated at the construction permit or combined license stage in full. The U.S. Nuclear Regulatory Commission's understandings and expectations regarding the use of the plant parameter envelope approach for the preparation and review of early site permit applications are in Section 3.2 of the environmental impact statement and in a February 5, 2003 letter to the Nuclear Energy Institute (NRC 2003). The staff's application of System Energy Resources, Inc.'s plant parameter envelope approach in the environmental impact statement is consistent with these understandings and expectations. This comment did not result in a change to the environmental impact statement.*

Comment: Yet, this draft EIS fails to consider or to fully acknowledge numerous environmental issues that could demonstrate that the Grand Gulf site is not suitable for an additional nuclear unit. The arbitrary separation of the ESP and COL processes compromises the ability of the U.S. Nuclear Regulatory Commission (NRC) to perform a thorough and adequate evaluation—at either stage or in total—of the potential environmental impacts from new reactor development. Under this regime—designed to "provide stability in the licensing process" (EIS, § 1.3)—far too many environmental impact considerations have been deferred to the COL stage of the licensing process. Time and time again throughout the draft EIS, the NRC staff reports its incapacity to conduct a realistic environmental evaluation because a specific reactor design has not yet been chosen by the applicant. Unfortunately, this disjointed method renders much of this environmental evaluation mere guesswork and conjecture. (AM-2)

Response: *As stated in NRC's ESP Review Standard RS-002 (NRC 2004), the purpose of the ESP regulations in 10 CFR Part 52 is, in part, to make it possible to resolve safety and environmental issues related to siting before an applicant needs to make large commitments of resources. Having obtained an ESP, an applicant for a construction permit (CP) or combined license (COL) for a nuclear power plant or plants can then reference it in the CP or COL application. In accordance with 10 CFR 52.39, site-related issues resolved at the ESP stage will be treated as resolved at the CP or COL stage unless a contention is admitted that a reactor does not fit within one or more of the site parameters in the ESP, a petition alleges that the site is not in compliance with the ESP, or a petition that the terms and conditions of the ESP should be modified. Issues not resolved at the ESP stage will be evaluated at the CP or COL stage in full. The public had an opportunity to comment on the 10 CFR Part 52 ESP regulations prior to their promulgation. This comment did not result in a change to the EIS.*

Comment: How much of the information in the ESP was provided by SERI? (AS-5)

Response: *In preparing the environmental impact statement, the staff used information supplied by System Energy Resources, Inc. in its early site permit application (10 CFR 52.17, 51.45, and 51.50). However, the staff conducted an independent review of the data and analyzed the impacts associated with the proposed action. This comment did not result in a change to the environmental impact statement.*

Comment: The operator of the Grand Gulf Nuclear Station (GGNS)—System Energy Resources, Inc. (SERI), a subsidiary of Entergy Corporation—did not include in its ESP application a "Site Redress Plan" and so would not be allowed to perform any site-preparation activities prior to issuance of a CP or COL (EIS, § 1.1.2). However, a second reactor, cooling tower, and ancillary structures that were partially constructed at the GGNS may be suitable for completion. While SERI has not firmly committed to constructing a new nuclear unit at the GGNS or even selected a specific reactor design (EIS, pg. 1-7), its parent, Entergy, is part of an industry consortium called NuStart Energy Development that plans to apply for a COL. If granted an ESP, SERI would have overcome a significant regulatory hurdle while numerous important issues, such as the need for power and the indefinite storage of additional waste onsite, have not been addressed. (AM-3)

Response: *System Energy Resources, Inc. is the applicant for the early site permit, but is not the operator of the Grand Gulf Nuclear Station. Need for power need not be addressed as part of the U.S. Nuclear Regulatory Commission's review of an early site permit application, but would be addressed in a subsequent environmental impact statement if an early site permit holder elected to apply for a construction permit or a combined license for a new nuclear power plant (10 CFR 52.18). The environmental impacts of radioactive waste are discussed in Section 6.1.1.6 of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Section 8 of the DEIS discusses impacts of the alternatives to building a nuclear facility. Throughout this section it is stated that SERI made the decisions about site selection, alternatives, capacity, etc. Because of decisions SERI will make in the future, "energy alternatives not requiring new generating capacity are not evaluated further in this EIS" (DEIS 8-4). SERI has indicated that the new reactor will be the type that will allow the company to sell power on an open market. While I am not opposed to Entergy making a profit, I think it is inexcusable that the public will be endangered so that profits can be made. Also, the alternative site selection process conducted by Entergy Nuclear (page 8-31), was most likely not in the best interest of the surrounding area or the Country, but in Entergy's best interest. The NRC should reevaluate and revamp this process so that the public good is considered a high priority and so that process is not controlled by nor biased towards the utility. The party with a vested interest in receiving the ESP should not be the primary party determining what is evaluated. The ESP process is biased and needs to be changed. While I know that the staff also performed independent reviews in some cases, there are numerous references to SERI's control of the process in the DEIS. (AN-11)

Response: *The U.S. Nuclear Regulatory Commission's mission is to regulate the nation's civilian use of by-product, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. Any Commission decision on the application for an early site permit by System Energy Resources, Inc. would be consistent with this mission. In preparing the environmental impact statement, the staff used information supplied by System Energy Resources, Inc. in its application but conducted an independent review and analysis. The staff concluded in Section 8.4.2.2 of the environmental impact statement that the overall site selection process for alternative sites was reasonable. This comment did not result in a change to the environmental impact statement.*

Comment: The Vagueness of the PPE: No specific plant design has been chosen for the new nuclear unit at the GGNS; instead, a plant parameter envelope (PPE)—a set of "bounding parameters"—has been specified (EIS, § 3.2). The PPE encompasses "one or two new nuclear units generating as much as 8600 megawatts thermal (MW(t)) or 3000 megawatts electric (MW(e)) output" (EIS, § 3.0). The scope of reactor types considered within the PPE—including five light water reactors (LWR) and two gas-cooled reactor types, not all of which have been approved by the NRC (EIS, § 3.2)—is far too broad, making it impossible to provide a reasonably precise judgment of the environmental impact of a new nuclear unit at the GGNS, especially considering that SERI is not even required to employ any one of these designs if it ultimately decides to build a new nuclear unit at the GGNS (EIS, pg. 3-4). The EPA, in commenting on the draft EIS for a similar new nuclear development, criticized the NRC for this imprecision, noting that "[t]here is inadequate design information available for some of the proposed units from which to make accurate environmental assessments of the impacts." The inaccuracy of this review system is belied by the NRC staff's admission that they neglected to review SERI's PPE values for correctness (EIS, pg. 3-5). Furthermore, SERI has considered a wet-dry hybrid design for its cooling system, but this model [is] not included in the PPE (EIS, § 3.2.2). It is improper for the NRC to assume that a set of bounding criteria can replace with any degree of precision the kind of evaluation that would be performed referencing a particular type of reactor. (AM-4)

Response: *In lieu of detailed design information, System Energy Resources, Inc. referenced a plant parameter envelope as a surrogate for a specific design. The plant parameter envelope provides bounding values of design parameters for a plant that might be constructed at the Grand Gulf early site permit site. The U.S. Nuclear Regulatory Commission staff evaluated the environmental impacts associated with those bounding values. A specific design is not needed* *because the plant parameter envelope values submitted are reasonable and sufficient to permit a meaningful environmental analysis. The U.S. Nuclear Regulatory Commission's understandings and expectations regarding the use of the plant parameter envelope approach for the preparation and review of early site permit applications are in Section 3.2 of the environmental impact statement and in a February 5, 2003 letter to the Nuclear Energy Institute (NRC 2003). The staff's application of System Energy Resources, Inc.'s plant parameter envelope approach in the environmental impact statement is consistent with these understandings and expectations. This comment did not result in a change to the environmental impact statement.*

Comment: I want to reiterate Ruth Pullen's statement about significant information missing from the DEIS, which is therefore incomplete and should not have been submitted in its current condition. (AO-5)

Response: *This comment does not provide any specific information or recommendations for additional analysis concerning the significant missing information. The draft environmental impact statement was prepared based on the applicant's environmental report, which contained the information required by 10 CFR 52.17(a)(2), 51.45, and 51.50. The draft environmental impact statement was prepared in accordance with the provisions of 10 CFR 51.70, 51.71, and 52.18. This comment did not result in a change to the environmental impact statement.*

Subject: Cost of Power

Comment: As a few people have alluded to tonight, and Mr. Williams stated that, you know, that they're not going to build one till it's economically feasible for the customers. (M-1)

Response: *An early site permit is a Commission approval of a site or sites for one or more nuclear power facilities. The filing of an application for an early site permit is a process that is separate from the filing of an application for a construction permit and operating license or a combined license for such a facility. The early site permit application makes it possible to evaluate and resolve safety and environmental issues related to siting before the applicant makes large commitments of resources. If the early site permit is approved, the applicant can "bank" the site for up to 20 years for future reactor siting. The early site permit does not authorize construction or operation of a nuclear power plant. If an early site permit holder decides to pursue construction, it must obtain a construction permit or a combined license, the issuance of which would be a major Federal action requiring preparation of an environmental impact statement under 10 CFR 51.20 that, among other things, would address the benefits of the proposed action, such as the need for power and cost of power. This comment did not result in a change to the environmental impact statement.*

Comment: Nuclear Power is Too Expensive: The economics of nuclear power remain so unattractive that without additional federal subsidies, no new plants will be built. (AC-4)

Response: *The regulations under 10 CFR 52.18 specify that the environmental impact statement prepared for an early site permit need not include an assessment of the benefits (for example, need for power) of the proposed action. Cost of power is part of the assessment of the need for power. These issues would be reviewed at the combined license stage because they were not reviewed at the early site permit stage (10 CFR 52.89). The Atomic Energy Act, as amended, prohibits the U.S. Nuclear Regulatory Commission from promoting nuclear power in any manner including rebates and incentives. This comment did not result in a change to the environmental impact statement.*

Comment: I'd also like to remind you that cost has not really been addressed yet. You'll remember that the first reactor had a huge cost overrun. It was very expensive, so expensive that Claiborne County was forced to subsidize all the other – half the other counties in Mississippi to cover that up, and disguise the fact that people's electricity rates were going up so much. (I-5)

Response: *The regulations under 10 CFR 52.18 specify that the environmental impact statement prepared for an early site permit need not include an assessment of the benefits (for example, need for power) of the proposed action. Cost of power is part of the assessment of the need for power. These issues would be reviewed at the combined license stage because they have not been reviewed at the early site permit stage (10 CFR 52.89). Tax treatment of the postulated facility is a matter of Mississippi State and local law. Sections 2.8.2.3, 4.5.3.2, and 5.5.3.2 address the treatment of the existing Grand Gulf Nuclear Station and any future plants in relation to State and local tax receipts. This comment did not result in a change to the environmental impact statement.*

Subject: Cultural Resources

Comment: Page 2-78 discusses compliance with the National Historic Preservation Act (NHPA 1966). Although no responses to letters were received from the Advisory Council on Historic Preservation (ACHP), Mississippi Department of Archives and History, and three tribal governments, there was not any discussion on further plans for coordination. (AZ-18)

Response: *Sections 2.9.3, 4.6, and 5.6 of the environmental impact statement indicate that the U.S. Nuclear Regulatory Commission staff has interpreted its compliance with National Historic Preservation Act Section 106 with its environmental review conducted pursuant to the National Environmental Policy Act of 1969 (36 CFR 800.8). Although no comments were received during the early site permit review process, if an applicant references the early site permit in a future construction permit or combined license application, the U.S. Nuclear*

Regulatory Commission's review of such an application would be a separate undertaking for which the U.S. Nuclear Regulatory Commission would be required to take into account the effects on cultural resources. Further, as explained in Sections 4.6 and 5.6, in the event of an inadvertent discovery, site personnel would contact the State Historic Preservation Officer to determine further actions, which might involve additional consultations with the various parties. This comment did not result in a change to the environmental impact statement.

Subject: Cumulative Impacts

Comment: Page 7-9, Lines 32-38. This paragraph implies that "historical and cultural resources" could make a detectable contribution to the cumulative effect. However, Lines 13 – 19 on Page 7-9 states that the proposed units would not add to the cumulative impacts to historical and cultural resources beyond that identified in Sections 4.6 and 5.6, which were also considered SMALL. It appears that maybe "historical and cultural resources" should be deleted from Line 35. (AP-28)

Response: *Changes to lines 32-38 were made to clarify this issue. This comment resulted in a change to Section 7.6.*

Comment: Cumulative Impacts: The DEIS should incorporate more information on environmental and health-related cumulative effects. It should identify federal and non-federal commercial businesses and facilities which have environmental releases, and clearly define these releases to the air, water, and land. There is no discussion about the cumulative environmental impacts from chemical facilities, together with these existing and proposed additional nuclear power facilities. Existing regulated facilities within the project area should be discussed, and their potential impacts to communities within the surrounding areas if an accident occurs at the nuclear site. (AZ-26)

Response: *Cumulative impacts are discussed in Chapter 7 of the environmental impact statement. The staff's analysis of cumulative impacts took account of nearby commercial and industrial facilities. This comment did not result in a change to the environmental impact statement.*

Subject: Ecology

Comment: Page 4-9, Line 1-5. Construction Impacts on Wildlife. Specific locations of the power block, cooling towers, intake and discharge, pipelines, and borrow sites are "currently unknown" and "would be determined definitely before the CP or COL phase." SERI requests the staff consider revising the phrase "…before the CP …" to be consistent with page 4-10, line 25-25 ("…prior to or during…") (AP-10)

Response: *Section 4.4.1.1 has been revised to include the phrase "prior to or during the CP or COL phase."*

Comment: It is unclear whether any new transmission capacity would be required to serve a new nuclear unit at the GGNS. A transmission analysis conducted by the Federal Energy Regulatory Commission (FERC) would be deferred until a specific facility design is chosen (EIS, § 2.2.2; § 3.3), though there remains the possibility that new transmission lines will be required, which could result in the destruction of up to 1,056 acres of hardwood forest (EIS, pg. 4-10). But absent a more specific proposal by SERI, the actual environmental impact from this project cannot be realistically forecast, thus the EIS must be seen to be deficient in this regard. (AM-24)

Response: *The proposed action is the granting of an early site permit (ESP). This permit would not authorize construction or site preparation activities of any kind. If an ESP is granted and the ESP holder chooses to construct and operate a new nuclear facility at this site during the period of validity of the permit, an environmental impact statement would be required that would evaluate in depth all issues not considered or resolved in the impact assessment for the ESP, such as construction of new transmission capacity. These would be addressed at the construction permit or combined license stage as required by U.S. Nuclear Regulatory Commission regulations (10 CFR 51.71(b), 52.39(a)(2), 52.89). This comment did not result in a change to the environmental impact statement.*

Comment: Page 4-16, Line 40. Sentence beginning on this line and carrying over to Page 4-17 implies that SERI will be responsible for implementing plans for widening a transmission corridor. A more accurate statement would be "NRC expects that SERI will work with the appropriate State agencies and the transmission line owner to develop …" (AP-11)

Response: *The text here and at other places in the environmental impact statement (where the entity responsible for transmission line right-of-way maintenance is discussed) has been revised to clarify that Entergy Mississippi, Inc. (the transmission and distribution system owner and operator) has responsibility for vegetation maintenance in the transmission line rights-of way, and that it would be responsible for implementing any related plans developed by System Energy Resources, Inc. in coordination with the appropriate Federal and State agencies to minimize impacts to the Bayou Pierre and the crystal darter. This comment resulted in a change to Section 4.4.2.*

Comment: Page 5-27, Lines 21-23. Sentence implies that SERI will be responsible for implementing plans for maintenance of a transmission corridor. Sentence should state "The NRC expects that SERI will work with the appropriate Federal and State agencies and the transmission line owner/operator to develop …" (AP-15)

Response: *The text here and at other places in the environmental impact statement (where the entity responsible for transmission line right-of-way maintenance is discussed) has been revised to clarify that Entergy Mississippi, Inc. (the transmission and distribution system owner and operator) has responsibility for vegetation maintenance in the transmission line rights-of-way, and that it would be responsible for implementing any related plans developed by System Energy Resources, Inc. in coordination with the appropriate Federal and State agencies to minimize impacts to the Mississippi River and bayou darter. This comment resulted in a change to several sections of this environmental impact statement.*

Comment: Wetlands: The DEIS does not provide information on the acreage, delineation, and type of wetlands impacted by the construction and operation of the proposed facility, nor does it include mitigation plans for wetlands impacts. (AZ-25)

Response: *This environmental impact statement does not provide this kind of detail because the purpose of this environmental impact statement is to provide enough information to make a decision regarding the environmental acceptability of the Grand Gulf early site permit site for future construction of one or more new nuclear units. An early site permit, if granted, for the Grand Gulf early site permit site would not allow any construction or ground-disturbing activities. If an early site permit were granted and an applicant subsequently submitted a construction permit or combined license application, the application would provide information on delineated wetlands, among other things. However, Chapter 4 of this environmental impact statement has been revised to state that before receiving a construction permit or a combined license, an applicant would submit an application for a Clean Water Act Section 404 permit to the U.S. Army Corps of Engineers that would address wetland filling, vegetation clearing, hydrological alterations, and related matters. This permitting process would ensure that impacts of construction would be limited by requiring that the appropriate construction best management and mitigation practices be followed. This comment resulted in a change to Chapter 4 of this environmental impact statement.*

Comment: The proposed project could adversely impact wetlands and other waters associated with the Mississippi River. The Department will provide additional comments regarding wetland impacts during the U.S. Army Corps of Engineers permitting process. We recommend that the applicant coordinate early in the planning process with the State and Federal resource agencies. These agencies should be contacted for recommendations on measures needed to mitigate adverse impacts and compensate for unavoidable losses to fish and wildlife values. (AH-2)

Response: *The staff analyzed construction impacts to these resources in the environmental impact statement. This environmental impact statement has been revised at all necessary places in the text to state that before receiving a construction permit or combined license, an applicant would submit an application for a Clean Water Act Section 404 permit to the U.S.*

Army Corps of Engineers that would address wetland filling, vegetation clearing, hydrological alterations, and related matters. This permitting process would ensure that impacts of construction would be limited by requiring that the appropriate construction best management and mitigation practices be followed. The applicant and U.S. Nuclear Regulatory Commission staff have contacted State (e.g., Mississippi Department of Wildlife, Fisheries and Parks) and Federal (e.g., U.S. Fish and Wildlife Service) agencies as part of the current National Environmental Policy Act of 1969 process. The early site permit for Grand Gulf, if granted, would not provide for any construction or ground-disturbing activities that could affect fish and wildlife. If an early site permit is granted and an application is submitted for a construction permit or combined license, the applicant would provide information in the application regarding its contact with State and Federal agencies to solicit recommendations for reducing and mitigating impacts to fish and wildlife. This comment resulted in a change to several sections of this environmental impact statement.

Subject: Editorial

Comment: Page 2-11, Line 40. NRC states that Vicksburg MS is about 32 km (20 mi) north of the ESP site. On page xxiii (Executive Summary) and pages 1-5 and 2-63, NRC states that Vicksburg is 40 km (25 mi) from the ESP site. On these pages, NRC also states that Port Gibson in [is] 10 km (6 mi) from the ESP site, while in page 2-3, NRC states that Port Gibson is 8 km (5 mi) from the ESP site. Port Gibson is 6 miles southeast of the site, according to Section 2.1 of the ER. (AP-3)

Response: *Distance inconsistencies were corrected as suggested. This comment resulted in a change to Chapter 2.*

Comment: Page 5-85, Line 17. Scott, M.J. 2004. This accession number leads to NUREG 1817 (this document), not the Scott, 2004 reference. The Scott, 2004 reference was located by doing a word search on the title. The reference was included in a more general reference: Enclosed copies of Information at the PNNL gathered and referenced in the Grand Gulf Early Site Permit Environmental Impact Statement. Accession Number: ML050350147. (AP-27)

Response: *ADAMS was changed to connect the document indicated. This comment did not result in a change to the environmental impact statement.*

Comment: Page 8-8, Line 36, 4th paragraph. The last sentence of this paragraph states: "There are no mandatory Class I Federal areas in Mississippi." It does not say anything about Louisiana. The Grand Gulf ESP site is just across the Mississippi River from Louisiana, thus the presence of mandatory Class I Federal areas in Louisiana should be addressed. (AP-30)

Response: *Section 8.2.2 of the environmental impact statement has been revised in response to this comment. The Breton Wilderness is the only Class I area in Louisiana, but it is not within 160 km (100 mi) of the Grand Gulf site.*

Comment: Page 8-59, Line 11-12. Recommend changing "Massachusetts Department of Environmental Protection" to "Environmental Protection Agency" since the EPA issues the NPDES Permit and administers the NPDES Program. The state agency does not currently have authorization for the NPDES Program. (AP-34)

Response: *Section 8.5 of the environmental impact statement has been revised to indicate that thermal and chemical discharges would be regulated by the Massachusetts Department of Environmental Protection and the U.S. Environmental Protection Agency.*

Comment: Page 3-1, Line 25 refers to the "reactor building." Line 21 correctly references the "containment." (AP-5)

Response: *The suggested wording was used. This comment resulted in a change to Chapter 3.*

Comment: In addition, Appendix I apparently includes some editorial errors in that SSAR Table 1.4-1 is incorrectly reproduced in this appendix. This SSAR table, dealing with compliance to Regulatory Guides, is not relevant and should be deleted from this appendix. (AP-38)

Response: *Table 1.4-1 was deleted and other tables rearranged. This comment resulted in a change to Appendix I.*

Comment: Appendix I is referenced from numerous locations in the DEIS text, for example, Sections 1.1.3, 1.2, etc. Appendix I is understood from the discussion in these DEIS sections to contain parameter values used as surrogate for proposed facility for the purposes of evaluating environmental impact in the Application's Environmental Report. However, Appendix I incorrectly presents PPE values from the Application's SSAR (SSAR Tables 1.3-1 and 1.3-2). It is noted that the ER references SSAR 1.3 for general discussion of the PPE concept. It is also recognized that the listings of PPE values supporting safety analyses (SSAR Table 1.3-1, etc.) are similar but not the same as those used for evaluating environmental impacts. The correct (PPE) listings of parameters used for the ER's evaluation of environmental impacts, as discussed in ER Section 3.0, are provided in ER Tables 3.0-1 through 3.0-8. Therefore, Appendix I should present the ER Tables 3.0-1 through 3.0-8 (and Table 3.0-9, if the Staff intended to also include PPE definitions). (AP-37)

Response: *The complete plant parameter envelope from Section 3 of the System Energy Resources, Inc. environmental report was used in the environmental impact assessment and will replace the abbreviated plant parameter envelope table from the site safety analysis report that was included in Appendix I in the draft environmental impact statement. This comment resulted in a change to Appendix I.*

Comment: Page 5-48, Line 31. Addresses one unit, similar comment as comment 1; i.e., some of the evaluated plant types included multiple reactor units. (AP-17)

Comment: Page 5-50, Line 27. The DEIS states: "The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for up to two new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site." Page xxiii, Lines 40 through 42 – "This EIS addresses the potential environmental impacts resulting from construction and operation of up to two new nuclear units at the proposed and alternative sites." Page xxiv, Lines 10 through 12 – "the staff determined and evaluated the potential environmental impact of constructing and operating up to two new nuclear units at the Grand Gulf ESP site." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. Clarification is needed in the EIS to define what the NRC means by two nuclear units. In a footnote in the SSAR PPE Table 1.3-1: "The values in brackets reflects the values corresponding to a plant that is twice the vendor's specified standard size plant, i.e., two ABWR units, two AP1000 units, six IRIS units, two sets of four GT-MHR modules, two sets of eight PBMR modules and two twin ACR-700 units..." Section 3.0 of the ER states: "…The evaluations of the potential environmental effects of the plant are based on bounding information from the Plant Parameters Envelope (PPE) presented in Table 3.0-1 through Table 3.0-8. A description of the development and intended use of the PPE is provided in Section 1.3 of the Site Safety Analysis Report, Part 2 of this Application for an Early Site Permit." Section 1.3 of the SSAR states: "The light-water-cooled technologies considered include the ABWR (Advanced Boiling Water Reactor), the ESBWR (Economic Simplified Boiling Water Reactor), the AP-1000 (Advanced Passive PWR), the IRIS (International Reactor Innovative and Secure), and the ACR-700 (Advanced CANDU Reactor). The ABWR is a single unit, 4300 MWt, 1500 MWe reactor. The ESBWR is a similar BWR, single unit, 4000 MWt, 1390 MWe. The AP-1000 pressurized-water reactor single unit specifications are 3400 MWt and 1117-1150 MWe. The IRIS is a three module pressurized-water reactor configuration with a total of 3000 MWt and 1005 MWe. And the ACR-700 is a twin unit, 3964 MWt, 1462 MWe, light-water-cooled reactor with a heavy-water moderator. There were two gas-cooled reactor technologies considered in the PPE development. These gas-cooled reactor technologies are the GT-MHR (Gas Turbine-Modular Helium Reactor), and the PBMR (Pebble Bed Modular Reactor). The GT-MHR is a four module, 2400 MWt, 1150 MWe gas-cooled reactor. The PBMR is an eight module, 3200 MWt, 1280 MWe gas-cooled reactor." Section 1.3.1.4 of the

SSAR says, in the second paragraph: "…For example, for single reactor units, the types considered represented capacities ranging from 160 MWe to 1500 MWe. In order to facilitate comparison between the different plant types in the PPE, the number of units/modules of a specific reactor type was chosen, based on vendors recommended combinations, to approximate 1000 MWe. This resulted in "single-unit plants" with capacities in the range of 1005 MWe to 1500 MWe." SERI recommends the staff consider the phrase "… one or more new nuclear units …" as being a more accurate description consistent with the ESP application; this would be consistent with the staff's language on page 7-10, line 38. (AP-21)

Response: *The U.S. Nuclear Regulatory Commission staff agrees that the terms are inconsistent in many places in the source documentation. As stated in the Site Safety Analysis Report provided by System Energy Resources, Inc., dose rate estimates were performed on a single-unit basis in some cases (e.g., liquid pathway doses) and on a full plant parameter envelope basis for others. This is reflected in the titles and footnotes of the text and various tables in Section 5.9. This comment did not result in a change to the environmental impact statement.*

Comment: Page xxiii, Lines 26 through 29, the DEIS states: "The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for up to two new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site." Page xxiii, Lines 40 through 42 – "This EIS addresses the potential environmental impacts resulting from construction and operation of up to two new nuclear units at the proposed and alternative sites." Page xxiv, Lines 10 through 12 – "the staff determined and evaluated the potential environmental impact of constructing and operating up to two new nuclear units at the Grand Gulf ESP site." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. Clarification is needed in the EIS to define what the NRC means by two nuclear units. In a footnote in the SSAR PPE Table 1.3-1: "The values in brackets reflects the values corresponding to a plant that is twice the vendor's specified standard size plant, i.e., two ABWR units, two AP1000 units, six IRIS units, two sets of four GT-MHR modules, two sets of eight PBMR modules and two twin ACR-700 units..." Section 3.0 of the ER states: "…The evaluations of the potential environmental effects of the plant are based on bounding information from the Plant Parameters Envelope (PPE) presented in Table 3.0-1 through Table 3.0-8. A description of the development and intended use of the PPE is provided in Section 1.3 of the Site Safety Analysis Report, Part 2 of this Application for an Early Site Permit." Section 1.3 of the SSAR states: "The light-water-cooled technologies considered include the ABWR (Advanced Boiling Water Reactor), the ESBWR (Economic Simplified Boiling Water Reactor), the AP-1000 (Advanced Passive PWR), the IRIS (International Reactor Innovative and Secure), and the ACR-700 (Advanced CANDU Reactor). The ABWR is a single unit, 4300 MWt, 1500 MWe reactor. The

ESBWR is a similar BWR, single unit, 4000 MWt, 1390 MWe. The AP-1000 pressurized-water reactor single unit specifications are 3400 MWt and 1117-1150 MWe. The IRIS is a three module pressurized-water reactor configuration with a total of 3000 MWt and 1005 MWe. And the ACR-700 is a twin unit, 3964 MWt, 1462 MWe, light-water-cooled reactor with a heavy-water moderator. There were two gas-cooled reactor technologies considered in the PPE development. These gas-cooled reactor technologies are the GT-MHR (Gas Turbine-Modular Helium Reactor), and the PBMR (Pebble Bed Modular Reactor). The GT-MHR is a four module, 2400 MWt, 1150 MWe gas-cooled reactor. The PBMR is an eight module, 3200 MWt, 1280 MWe gas-cooled reactor." Section 1.3.1.4 of the SSAR says, in the second paragraph: "…For example, for single reactor units, the types considered represented capacities ranging from 160 MWe to 1500 MWe. In order to facilitate comparison between the different plant types in the PPE, the number of units/modules of a specific reactor type was chosen, based on vendors recommended combinations, to approximate 1000 MWe. This resulted in "single-unit plants" with capacities in the range of 1005 MWe to 1500 MWe." SERI recommends the staff consider the phrase "… one or more new nuclear units …" as being a more accurate description consistent with the ESP application; this would be consistent with the staff's language on page 7-10, line 38. (AP-1)

Comment: Page 3-5, Line 10 - Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GTMHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. See comment 1 above. (AP-6)

Comment: Page 5-42, Line 10. Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. See comment 1 above. (AP-16)

Comment: Page 5-49, Line 9. "The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for up to two new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site." Page xxiii, Lines 40 through 42 – "This EIS addresses the potential environmental impacts resulting from construction and operation of up to two new nuclear units at the proposed and alternative sites." Page xxiv, Lines 10 through 12 – "the staff determined and evaluated the potential environmental impact of constructing and operating up to two new nuclear units at the Grand Gulf ESP site." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. Clarification is needed in the EIS to define what the NRC means by two nuclear units. In a footnote in the SSAR PPE Table 1.3-1: "The values in brackets reflects the values corresponding to a plant that is twice the vendor's specified standard size plant, i.e., two ABWR units, two AP1000 units, six IRIS units, two sets of four GT-MHR modules, two sets of eight PBMR modules and two twin ACR-700 units..." Section 3.0 of the ER states: "…The evaluations of the potential environmental effects of the plant are based on bounding information from the Plant Parameters Envelope (PPE) presented in Table 3.0-1 through Table 3.0-8. A description of the development and intended use of the PPE is provided in Section 1.3 of the Site Safety Analysis Report, Part 2 of this Application for an Early Site Permit." Section 1.3 of the SSAR states: "The light-water-cooled technologies considered include the ABWR (Advanced Boiling Water Reactor), the ESBWR (Economic Simplified Boiling Water Reactor), the AP-1000 (Advanced Passive PWR), the IRIS (International Reactor Innovative and Secure), and the ACR-700 (Advanced CANDU Reactor). The ABWR is a single unit, 4300 MWt, 1500 MWe reactor. The ESBWR is a similar BWR, single unit, 4000 MWt, 1390 MWe. The AP-1000 pressurized-water reactor single unit specifications are 3400 MWt and 1117-1150 MWe. The IRIS is a three module pressurized-water reactor configuration with a total of 3000 MWt and 1005 MWe. And the ACR-700 is a twin unit, 3964 MWt, 1462 MWe, light-water-cooled reactor with a heavy-water moderator. There were two gas-cooled reactor technologies considered in the PPE development. These gas-cooled reactor technologies are the GT-MHR (Gas Turbine-Modular Helium Reactor), and the PBMR (Pebble Bed Modular Reactor). The GT-MHR is a four module, 2400 MWt, 1150 MWe gas-cooled reactor. The PBMR is an eight module, 3200 MWt, 1280 MWe gas-cooled reactor." Section 1.3.1.4 of the SSAR says, in the second paragraph: "…For example, for single reactor units, the types considered represented capacities ranging from 160 MWe to 1500 MWe. In order to facilitate comparison between the different plant types in the PPE, the number of units/modules of a specific reactor type was chosen, based on vendors recommended combinations, to approximate 1000 MWe. This resulted in "single-unit plants" with capacities in the range of 1005 MWe to 1500 MWe." SERI recommends the staff consider the phrase "… one or more new nuclear units …" as being a more accurate description consistent with the ESP application; this would be consistent with the staff's language on page 7-10, line 38. (AP-18)

Comment: Page 5-50, Line 39. the DEIS states: "The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for up to two new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site." Page xxiii, Lines 40 through 42 – "This EIS addresses the potential environmental impacts resulting from construction and operation of up to two new nuclear units at the proposed and alternative sites." Page xxiv, Lines 10 through 12 – "the staff determined and evaluated the potential environmental impact of constructing and operating up to two new nuclear units at the Grand Gulf ESP site." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. Clarification is needed in the EIS to define what the NRC means by two nuclear units. In a footnote in the SSAR PPE Table 1.3-1: "The values in brackets reflects the values corresponding to a plant that is twice the vendor's specified standard size plant, i.e., two ABWR units, two AP1000 units, six IRIS units, two sets of four GT-MHR modules, two sets of eight PBMR modules and two twin ACR-700 units..." Section 3.0 of the ER states: "…The evaluations of the potential environmental effects of the plant are based on bounding information from the Plant Parameters Envelope (PPE) presented in Table 3.0-1 through Table 3.0-8. A description of the development and intended use of the PPE is provided in Section 1.3 of the Site Safety Analysis Report, Part 2 of this Application for an Early Site Permit." Section 1.3 of the SSAR states: "The light-water-cooled technologies considered include the ABWR (Advanced Boiling Water Reactor), the ESBWR (Economic Simplified Boiling Water Reactor), the AP-1000 (Advanced Passive PWR), the IRIS (International Reactor Innovative and Secure), and the ACR-700 (Advanced CANDU Reactor). The ABWR is a single unit, 4300 MWt, 1500 MWe reactor. The ESBWR is a similar BWR, single unit, 4000 MWt, 1390 MWe. The AP-1000 pressurized-water reactor single unit specifications are 3400 MWt and 1117-1150 MWe. The IRIS is a three module pressurized-water reactor configuration with a total of 3000 MWt and 1005 MWe. And the ACR-700 is a twin unit, 3964 MWt, 1462 MWe, light-water-cooled reactor with a heavy-water moderator. There were two gas-cooled reactor technologies considered in the PPE development. These gas-cooled reactor technologies are the GT-MHR (Gas Turbine-Modular Helium Reactor), and the PBMR (Pebble Bed Modular Reactor). The GT-MHR is a four module, 2400 MWt, 1150 MWe gas-cooled reactor. The PBMR is an eight module, 3200 MWt, 1280 MWe gas-cooled reactor." Section 1.3.1.4 of the SSAR says, in the second paragraph: "…For example, for single reactor units, the types considered represented capacities ranging from 160 MWe to 1500 MWe. In order to facilitate comparison between the different plant types in the PPE, the number of units/modules of a specific reactor type was chosen, based on vendors recommended combinations, to approximate 1000 MWe. This resulted in "single-unit plants" with capacities in the range of 1005 MWe to 1500 MWe." SERI recommends the staff consider the phrase "… one or more new nuclear units …" as being a more accurate description consistent with the ESP application; this would be consistent with the staff's language on page 7-10, line 38. (AP-22)

Comment: Page 3-1, Lines 9 & 10 - the NRC says: "...constructing and operating up to two new nuclear units." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. See Comment 1 above. (AP-4)

Comment: Page 5-55, Line 4, the DEIS states: "The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for up to two new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site." Page xxiii, Lines 40 through 42 – "This EIS addresses the potential environmental impacts resulting from construction and operation of up to two new nuclear units at the proposed and alternative sites." Page xxiv, Lines 10 through 12 – "the staff determined and evaluated the potential environmental impact of constructing and operating up to two new nuclear units at the Grand Gulf ESP site." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. Clarification is needed in the EIS to define what the NRC means by two nuclear units. In a footnote in the SSAR PPE Table 1.3-1: "The values in brackets reflects the values corresponding to a plant that is twice the vendor's specified standard size plant, i.e., two ABWR units, two AP1000 units, six IRIS units, two sets of four GT-MHR modules, two sets of eight PBMR modules and two twin ACR-700 units..." Section 3.0 of the ER states: "…The evaluations of the potential environmental effects of the plant are based on bounding information from the Plant Parameters Envelope (PPE) presented in Table 3.0-1 through Table 3.0-8. A description of the development and intended use of the PPE is provided in Section 1.3 of the Site Safety Analysis Report, Part 2 of this Application for an Early Site Permit." Section 1.3 of the SSAR states: "The light-water-cooled technologies considered include the ABWR (Advanced Boiling Water Reactor), the ESBWR (Economic Simplified Boiling Water Reactor), the AP-1000 (Advanced Passive PWR), the IRIS (International Reactor Innovative and Secure), and the ACR-700 (Advanced CANDU Reactor). The ABWR is a single unit, 4300 MWt, 1500 MWe reactor. The ESBWR is a similar BWR, single unit, 4000 MWt, 1390 MWe. The AP-1000 pressurized-water reactor single unit specifications are 3400 MWt and 1117-1150 MWe. The IRIS is a three module pressurized-water reactor configuration with a total of 3000 MWt and 1005 MWe. And the ACR-700 is a twin unit, 3964 MWt, 1462 MWe, light-water-cooled reactor with a heavy-water moderator. There were two gas-cooled reactor technologies considered in the PPE development. These gas-cooled reactor technologies are the GT-MHR (Gas Turbine-Modular Helium Reactor), and the PBMR (Pebble Bed Modular Reactor). The GT-MHR is a four module, 2400 MWt, 1150 MWe gas-cooled reactor. The PBMR is an eight module, 3200 MWt, 1280 MWe gas-cooled reactor." Section 1.3.1.4 of the SSAR says, in the second paragraph: "…For example, for single reactor units, the types considered represented capacities ranging from 160 MWe to 1500 MWe. In order to facilitate comparison between the different plant types in the PPE, the number of units/modules of a specific reactor type was chosen, based on vendors recommended combinations, to approximate 1000 MWe. This resulted in "single-unit plants" with capacities in the range of 1005 MWe to 1500 MWe." SERI recommends the staff consider the phrase "… one or more new nuclear units …" as being a more accurate description consistent with the ESP application; this would be consistent with the staff's language on page 7-10, line 38. (AP-25)

Comment: DEIS Page 1-4 DEIS Line 39, the DEIS states: "The purpose of SERI's requested action, issuance of the ESP, is for the NRC to determine whether the Grand Gulf ESP site is suitable for up to two new nuclear units by resolving certain safety and environmental issues before SERI incurs the substantial additional time and expense of designing and seeking approval to construct such units at the site." Page xxiii, Lines 40 through 42 – "This EIS addresses the potential environmental impacts resulting from construction and operation of up to two new nuclear units at the proposed and alternative sites." Page xxiv, Lines 10 through 12 – "the staff determined and evaluated the potential environmental impact of constructing and operating up to two new nuclear units at the Grand Gulf ESP site." Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. Clarification is needed in the EIS to define what the NRC means by two nuclear units. In a footnote in the SSAR PPE Table 1.3-1: "The values in brackets reflects the values corresponding to a plant that is twice the vendor's specified standard size plant, i.e., two ABWR units, two AP1000 units, six IRIS units, two sets of four GT-MHR modules, two sets of eight PBMR modules and two twin ACR-700 units..." Section 3.0 of the ER states: "…The evaluations of the potential environmental effects of the plant are based on bounding information from the Plant Parameters Envelope (PPE) presented in Table 3.0-1 through Table 3.0-8. A description of the development and intended use of the PPE is provided in Section 1.3 of the Site Safety Analysis Report, Part 2 of this Application for an Early Site Permit." Section 1.3 of the SSAR states: "The light-water-cooled technologies considered include the ABWR (Advanced Boiling Water Reactor), the ESBWR (Economic Simplified Boiling Water Reactor), the AP-1000 (Advanced Passive PWR), the IRIS (International Reactor Innovative and Secure), and the ACR-700 (Advanced CANDU Reactor). The ABWR is a single unit, 4300 MWt, 1500 MWe reactor. The ESBWR is a similar BWR, single unit, 4000 MWt, 1390 MWe. The AP-1000 pressurized-water reactor single unit specifications are 3400 MWt and 1117-1150 MWe. The IRIS is a three module pressurized-water reactor configuration with a total of 3000 MWt and 1005 MWe. And the ACR-700 is a twin unit, 3964 MWt, 1462 MWe, light-water-cooled reactor with a heavy-water moderator. There were two gas-cooled reactor technologies considered in the PPE development. These gas-cooled reactor technologies are the GT-MHR (Gas Turbine-Modular Helium Reactor), and the PBMR (Pebble Bed Modular Reactor). The GT-MHR is a four module, 2400 MWt, 1150 MWe gas-cooled reactor. The PBMR is an eight module, 3200 MWt, 1280 MWe gas-cooled reactor." Section 1.3.1.4 of the SSAR says, in the second paragraph: "…For example, for single reactor units, the types considered represented capacities ranging from 160 MWe to 1500 MWe. In order to facilitate comparison between the different plant types in the PPE, the number of units/modules of a specific reactor type was chosen, based on vendors recommended combinations, to approximate 1000 MWe. This resulted in "single-unit plants" with capacities in the range of 1005 MWe to 1500 MWe." SERI recommends the staff consider the phrase "… one or more new nuclear units …" as being a more accurate description consistent with the ESP application; this would be consistent with the staff's language on page 7-10, line 38. (AP-2)

Comment: DEIS Page 3-6, Lines 7 & 8 - Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GT-MHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. See comment 1 above. (AP-7)

Comment: Page 3-6, Line 16 - Some of the plant types have more than two reactor units; i.e., IRIS, 6 Reactors, GTMHR, 8 Reactors, PBMR, 16 Reactors, ACR-700, 4 Reactors. See comment 1 above. (AP-8)

Response: *The U.S. Nuclear Regulatory Commission staff agrees that the terms are inconsistent in many places in the source documentation. Where appropriate, the environmental impact statement was changed to refer to "one or more new nuclear units" instead of "up to two new nuclear units." These comments resulted in a change to several sections of this environmental impact statement.*

Comment: The FEIS should incorporate a matrix that outlines potential environmental, economic and social risks, burdens and benefits, and their associated magnitude. (AZ-28)

Response: *The requested matrix of effects appears at the back of Chapters 4, 5, 9, and 10. This comment did not result in a change to the environmental impact statement.*

Comment: Page 8-39, Line 40. Recommend that "River Bend Units 1 and 2" be changed to "River Bend Station" since there is only one unit on-site. (AP-32)

Response: *The staff agrees with this comment and made the suggested change to Section 8.5.1.2.*

Comment: Page 8-45, Line 31. Recommend that "River Bend Units 1 and 2" be changed to "River Bend Station" since there is only one unit on-site. (AP-33)

Response: *The staff agrees with this comment and made the suggested change to Section 8.5.1.4.*

Comment: Page 8-10, Line 10-22. 1st paragraph. The information presented in this section, and primarily in this paragraph, could lead one to conclude that construction and operation of a coal fired power plant would lead to a HIGH impact on land use, rather than a moderate as stated in the DEIS. (AP-31)

Response: *The staff believes that the land-use impacts described in Section 8.2.2.1 can be characterized as having a MODERATE impact. This comment did not result in a change to the environmental impact statement.*

Comment: Page 7-10, Line 39. Cumulative Impacts. The "duration of the proposed action" is listed as "from 2030 to 2070." Since this section is summarizing impact conclusions for both construction and operation, the initiating time could/should precede 2030. It may be better to use the phrase "(construction period plus 40 years of operation)" rather than trying to encompass calendar years. (AP-29)

Response: *The suggested wording was used. This comment resulted in a change to Section 7.9.*

Subject: Emergency Preparedness

Comment: I want to mention an additional aspect of safety concerns, especially for NRC readers who may not have driven past the GGNS. Since my first drive past the plant years ago through June 28, 2005, there has been an "evacuation route" sign not far beyond the plant (farther out in the country, toward the Mississippi River) which points evacuees BACK PAST THE PLANT in order to escape a disaster. This time I learned that the sign points that way because the road beyond the plant floods in heavy rains and cannot be used for evacuation to the main highway when flooded. (AO-1)

Comment: Because GGNS tax revenues have been diverted by state law from Claiborne County to about 40 other counties, no money has been available to build a viable road and bridges to provide an arguably defensible escape route to the north instead of back past the plant. The tax diversion makes this an environmental justice issue as well. This site is not safe for one plant, never mind for two. (Two or three side roads are not marked as to whether they have an outlet to the main highway - a special danger to tourists unfamiliar with the area who might get caught at Grand Gulf Military Park, beyond the plant from Port Gibson.) (AO-2)

Comment: Of particular concern is the need to aggressively engage our citizens in emergency planning. The need for effective warning devices in our population centers, and the need for interoperable communications between local first responders. (AU-5)

Comment: Of particular concern is the need to aggressively engage our citizens in emergency planning. The need for effective warning devices in our population centers, and the need for interoperable communications between local first responders. (B-5)

Response: *Emergency preparedness is outside the scope of the environmental review, but is evaluated in the Grand Gulf early site permit safety evaluation report (NRC 2005). The safety evaluation report is available at U.S. Nuclear Regulatory Commission's website, www.nrc.gov. In accordance with 10 CFR 52.18, the Commission determines in consultation with the Federal Emergency Management Agency, whether the information submitted by an early site permit applicant indicates that there are physical characteristics that could pose any significant impediment to the development of emergency plans. The staff determined in the safety evaluation report for the Grand Gulf early site permit site that no such impediments are present.*

The emergency planning issues that were raised during the environmental review were forwarded to the appropriate U.S. Nuclear Regulatory Commission safety project manager for consideration and appropriate action. These comments did not result in a change to the environmental impact statement.

Comment: A thorough evaluation needs to be conducted and incorporated in the FEIS related to vulnerability zones; assessing the proximity of resident and local workers, (e.g., chemical facilities, etc.); and generate possible design alternatives for the proposed action. If such vulnerability zones overlap the population with unacceptable levels of concern, causing adverse health effects, primary and secondary prevention systems can be advocated. (AZ-14)

Response: *Emergency preparedness is outside the scope of the environmental review but is evaluated in the Grand Gulf early site permit safety evaluation report (NRC 2005). The safety evaluation report is available at the U.S. Nuclear Regulatory Commission's website, www.nrc.gov. In accordance with 10 CFR 52.18, the U.S. Nuclear Regulatory Commission's staff determined in the final safety evaluation report for the Grand Gulf early site permit site, in consultation with the Federal Emergency Management Agency, that there are no physical characteristics that could pose significant impediments to the development of emergency plans. The term "vulnerability zone" is not one used in the U.S. Nuclear Regulatory Commission's regulations and guidance. The U.S. Nuclear Regulatory Commission uses emergency planning zones as the planning basis for response to radiological emergencies (10 CFR 50.47). The U.S. Nuclear Regulatory Commission is not the cognizant agency for non-radiological hazards and emergencies. This comment did not result in a change to the environmental impact statement.*

Comment: Further, in the twenty years of operation of GG I the county has not had sufficient funds to build the infrastructure to protect its citizenry in the event of an accident at the plant. The Claiborne County Sheriff's Department, "with a staff of only nine deputies…has concerns about the adequacy of its staffing to cover simultaneously its emergency responsibilities at GGNS as well as offsite evacuation." Claiborne County officials are concerned that the hospital is not adequately equipped to handle an emergency at the plant and also "believe their communications and transportation capability to evacuate patients is not adequate" (page 2-74). These are serious environmental justice and safety issues that should be addressed before consideration of an ESP goes forward. (AN-7)

Response: *Although the local hospital in Port Gibson does not have the full range of services available (Section 2.8.2.6), emergency plans for the Grand Gulf Nuclear Station itself rely on capabilities in Warren and Hinds counties. The local public officials in Claiborne and Jefferson counties clearly would prefer to have more medical and emergency response capability in their own jurisdiction, as also is discussed in Section 2.8.2.6. Emergency preparedness is outside the scope of the environmental review, but is evaluated in the Grand Gulf early site permit safety evaluation report (NRC 2005). The safety evaluation report is available at the U.S. Nuclear Regulatory Commission's website, www.nrc.gov. The U.S. Nuclear Regulatory Commission evaluates emergency plans for nuclear power reactors to determine when there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. The Commission must determine, in consultation with the Federal*

Emergency Management Agency, whether there is no significant impediment to the development of emergency plans. The determination was made during the Grand Gulf early site permit safety review. The emergency planning issues that were raised during the environmental review were forwarded to the appropriate U.S. Nuclear Regulatory Commission safety project manager for consideration and appropriate action. This comment did not result in a change to the environmental impact statement.

Comment: And a second point I wanted to address, in terms of safety evaluation, I know Mr. Raj had talked about how he – that evaluation was based on information from state and local agencies. And I'm aware that there were two affidavits filed, one by the police chief at the time stating that, in the event of an emergency, that he felt inadequately prepared and supported to facilitate an emergency evacuation of the people of Claiborne County. And that the hospital administrator stated the same – something along the same lines, that should there be a nuclear accident and people need emergency medical attention for exposure to radiation, this hospital would be unprepared to address that. (N-2)

Response: *Emergency planning is addressed in Section 2.8.2.6, and the impacts of construction and operation on police, fire, and medical services are addressed in Sections 4.5.4.4 and 5.5.4.4, including the concerns expressed in the comment. This comment did not result in a change to the environmental impact statement.*

Comment: If a spill occurred what about the millions of people using the water of the Mississippi for drinking, transportation, farming, fisheries. Why is there no ferry from Port Gibson to St. Joseph for evacuation or emergency purposes? (Y-3)

Response: *Impacts from accidents are evaluated in Section 5.10 of the environmental impact statement and were found to be small. The radiological impacts to members of the public from the liquid effluent pathway during normal operations was found to be small in Section 5.9.2. It is extremely unlikely that contaminated liquids from a design basis or severe accident would reach the Mississippi River. In the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NRC 1996), the staff evaluated risks of a severe accident with basemat melt-through for current generation power plants and concluded that the risks associated with releases to groundwater are smaller than those for the air pathway, which was found to be small for advanced light water reactors. The reasoning behind this conclusion is set forth in Section 5.10.2.3 of the environmental impact statement. The staff expects that groundwater pathway risks associated with advanced reactors would be smaller than those for current generation reactors. Emergency preparedness is outside the scope of the environmental review, but is evaluated in the Grand Gulf early site permit safety evaluation report (NRC 2005). The safety evaluation report is available at the U.S. Nuclear Regulatory Commission's website, www.nrc.gov. In addition, in the safety evaluation report, the staff determined, in consultation with the Federal Emergency Management Agency, that there are no* *physical characteristics that could pose significant impediments to the development of emergency plans. This comment did not result in a change to the environmental impact statement.*

Comment: We are concerned that Jefferson County has not been actively involved in participating in this radiological emergency planning activity. My purpose here today is to express our interest in being more actively involved in this process in the future. (AU-3, B-3)

Comment: The Jefferson County Board of Supervisors and the citizens of Jefferson County are concerned about the adequacy of emergency response planning in the vicinity of the nuclear reactor and want to assure that off-site radiological emergency planning is effective and can be fully implemented in a timely and coordinated manner during emergency events. Our review of the Stennis Institute white paper has illustrated, due to the complexity of these issues, the importance of preplanning for emergency events, raises our awareness of the importance of these issues to our community, and motivates us to become increasingly active in planning for the safety of our citizens. (AU-4, B-4)

Comment: Second, the current warning system for residents is woefully inadequate. My parents, for example can't even hear the sirens. They have no idea what the escape routes are, they don't usually listen to the radio or watch T.V., and would have great difficulty getting any information in a timely manner. (W-3)

Response: *The concerns identified by this comment have been passed to cognizant staff who are conducting the emergency planning portion of the safety review. Emergency preparedness is outside the scope of the environmental review, but is evaluated in the Grand Gulf early site permit safety evaluation report (NRC 2005). The safety evaluation report is available at the U.S. Nuclear Regulatory Commission's website, www.nrc.gov. In addition, in the safety evaluation report, the staff determined, in consultation with the Federal Emergency Management Agency, that there are no physical characteristics that could pose significant impediments to the development of emergency plans. These comments did not result in a change to the environmental impact statement.*

Comment: The local communities simply don't have anywhere near the needed resources to cope with any disaster that may occur. Claiborne county has been designated as a “health professional shortage area” by The Mississippi State Department of Health Office of Science (http://www.health.ms.gov/county/Claiborne.pdf) (X-3)

Response: *The environmental impact statement has been updated to include the designation of Claiborne County. This comment resulted in a change to Section 2.8.2.6.*

Comment: The information that is contained in the document suggests that the peculiar economic situation faced by the host community makes it unlikely that an emergency at the plant can be addressed in the necessary manner. (AY-2)

Response: *This comment contained no new information for additional analysis. This comment did not result in a change to the environmental impact statement.*

Subject: Energy Generation Ownership

Comment: I can't believe the United States would even consider letting China buy our gas companies or any properties that are of national concern. Why are we giving away our Country!!!!!! What about the security risks to us? We give and give taking away from the people of the United States and shouldn't we be thinking about how this is going to affect our nation? It seems to me that money has become the main issue when it comes [to] the United States and their decisions. Let's keep our country safe and take care of our needs before we consider one more way to give our nation away. Stop handing things over to foreigners; their agenda is [not] in our best interest. (AD-1)

Response: *The comment provides no new information for additional analysis. This comment did not result in a change to the environmental impact statement.*

Subject: Environmental Justice

Comment: The DEIS should contain racial and income demographic information in chart and narrative forms early in the report (Section 2.8, Socioeconomics). Although the information is illustrated in map form in Figure 2-12 and Figure 2-13, it would be beneficial for readers if it were presented in chart form with narrative explanations. For instance, the following demographics data should be included early in the report. According to the 2000 Census, African Americans are 12.3% of the population in the U.S., 36.3% of the population in Mississippi, 84.1% in Claiborne County and 80% in Port Gibson. (AW-8)

Comment: Also in the report, I think it would help in the front of the report if you would actually list the racial demographics so that your readers can see it more clearly. According to the 2000 census, African Americans are 12.3 percent of the population of the U.S., 36.3 percent of the population in Mississippi, 84.1 percent in Claiborne County, and 80 percent in Port Gibson. If that could be put in a chart form, I think it would help people in their analyses of the environmental – on the racial demographics of the report. (E-3)

Response: *A table has been added to Section 2.8.1 to provide the requested data. These comments resulted in a change to Section 2.8.1.*

Comment: The DEIS also does not address the impact on real estate values, particularly regarding residential property impacts to the environmental justice population, nor does the DEIS assess the impact on commercial real estate values in close proximity. Many of the residents within the immediate project area are low-income, and may not have much capacity to easily move away from their local community if they consider the additional nuclear power facilities unacceptable neighboring property. Research on existing real estate appreciation and depreciation since the original facility was constructed would be helpful, and projected appreciation/depreciation of real estate values would be important to include in the FEIS. (AZ-27)

Response: *Because of the uncertainties associated with residence choice of immigrating population, there is no reasonable basis on which to project future property values in the area surrounding the plant. Increases in population associated with facility construction and operation, even if fairly modest, would provide some support for local property values, for example. It also is possible to say that average mortgage loan amounts (and presumably, the associated market value of property) have generally increased in all local jurisdictions during the last 5 years, suggesting that the presence of the current Grand Gulf Nuclear Station is not a significant barrier to property values and sales. Property value changes have been added to the discussion in Sections 2.8.2.5, 4.5.4.3, 5.1.1, and 5.5.4.3.*

Comment: Environmental Justice: Based on the DEIS, the EJ evaluation was conducted based on guidance from the NRC Office of Nuclear Reactor Regulation Office. The document also states that conducting an EJ assessment is not a requirement for the NRC, but a voluntary undertaking. As part of the EJ assessment, the DEIS examines low-income and minority populations within a 50-mile (80 km) radius of the Grand Gulf Site, encompassing 16 counties in Mississippi and nine parishes in Louisiana. Both Mississippi and Louisiana have high minority and low-income populations within the potentially affected area. However, Claiborne, Jefferson, and Hinds counties have the heaviest concentration of exceptionally high minority populations, while Claiborne, Copiah, Jefferson County, Concorda Parish and Tensas Parish have the heaviest concentrations of low-income populations. The Grand Gulf Site is located in Claiborne County which has both the highest minority and low-income populations. The DEIS includes a GIS map of the counties and parishes with EJ considerations. While it is important to map all of the potential EJ areas in a 50-mile radius of the site, it would also be helpful to show in more detail the EJ areas that could face the most significant risk. For example, provision of GIS or aerial maps of EJ populations within close proximity to the Grand Gulf site (i.e., 0-5 miles) would be useful. The map(s) should indicate the distance of the closest residents to the current facility and the proposed expansion. Information regarding residential distribution and location is beneficial for community and regulatory assessment. (AZ-5)

Response: *Census mapping of minority and low-income populations at the census block group level shows that the entire area surrounding the Grand Gulf early site permit site out to*

8 km (5 mi) is within census block groups that are characterized as "minority" block groups. While it is not possible to guess whether the nearest residents are minority groups, the appearance of nearby housing stock suggests a mix of upper and lower-income occupants. Nothing significant would be gained by mapping the nearest housing stock along Grand Gulf road. This comment did not result in a change to the environmental impact statement.

Comment: Judging from the experience in Illinois, the institution of an unregulated merchant nuclear generating unit would better serve the profit motives of Entergy than the general welfare of the residents of Claiborne County, who would be burdened with the risks incumbent in hosting a nuclear power plant. Because Claiborne County is populated predominantly with minority and low-income people, these groups would be disproportionately impacted—probably adversely—by the addition of a new reactor at the GGNS. (AM-19)

Response: *It is not clear from this comment what experience in Illinois is being referenced. The Illinois experience with deregulation and taxes in Dewitt County is not directly germane. There, under deregulation, the management of an existing nuclear plant was able to negotiate a reduction in assessed property value because the basis for assessed value changed. In the case of the Grand Gulf site, no change in taxation of the existing plant is contemplated, so it will continue to generate revenue under existing provisions of the Mississippi State tax code. However, a new nuclear power plant, if it were treated as an ordinary industrial asset because of its merchant plant status, could yield considerable new tax revenue to local government. This likely would be true even if the assessed property value were negotiated downward or System Energy Resources, Inc. made payments to the local government in lieu of taxes. Potential impacts on minority and low-income persons are discussed in Sections 4.7 and 5.7. This comment did not result in a change to the environmental impact statement.*

Comment: EJ Benefits and Burdens: EJ evaluations should consider both the benefits and burdens and risks associated with the project, as it relates to EJ populations and the population at large. The DEIS discusses some of the potential risks and benefits of the project such as State Tax Revenue to the Claiborne County. Because of a Mississippi State Tax Code legislatively enacted in 1988, Claiborne County property tax revenue from the nuclear station was re-appropriated to more than 40 other Mississippi counties in Entergy's electricity distribution area. It is unclear how much of this revenue is paid per year to the State, relative to the amount that is then sent to Claibome County for general use. In addition, it appears that some local, municipal infrastructure and emergency services within Claibome County may not be adequately prepared for potential accidents, additional influx of workers, etc. (AZ-7)

Response: *The analysis in the environmental impact statement of taxes (Sections 2.8.2.3, 4.5.3.2, and 5.5.3.2) discusses the conditions under which the governments and populace of Claiborne County and Port Gibson may benefit from additional tax receipts as a result of a new nuclear power plant being constructed and operated at the Grand Gulf early site permit site.*

Section 2.8.2.3 states how the existing taxes are allocated, with Claiborne County receiving roughly a third of total property taxes collected by the state ($7.8 million out of a minimum of $20 million, $3 million of which is specifically for participation in the Grand Gulf Nuclear Station offsite emergency plan). However, the relative size of existing tax payments related to Grand Gulf Nuclear Station to local governments in Claiborne County versus other jurisdictions under the Mississippi Code provides limited assistance in determining what the future tax benefits would be from a future facility because the current law is very narrowly written. For example, it contains specific dollar amounts allocated to Port Gibson and Claiborne County for emergency management. It appears that the same allocation would also apply to a new facility, if it were generally treated in the same way for tax purposes. However, the postulated new facility is clearly intended in the applicant's environmental report as a merchant plant, so it is unclear if the provisions of the tax law would apply to a nuclear facility constructed for this purpose. The special nuclear plant tax provision applies only to nuclear power plants owned or operated by a utility rendering electric service in the State. But, as proposed by SERI, the facility instead would be treated as an ordinary industrial asset. Because of the uncertainties associated with residence choice of in-migrating population, there is no reasonable basis on which to project future property values in the area surrounding the plant. Increases in population associated with facility construction and operation, even if fairly modest, would provide some support for local property values, for example. It also is possible to say that average mortgage loan amounts (and presumably, the associated market value of property) have generally increased in all local jurisdictions during the last few years, suggesting that the presence of the current Grand Gulf Nuclear Station is not a significant barrier to property values and sales (see Section 5.1.1). Property value changes have been added to the discussion in Section 2.8.2.5, 4.5.4.3, and 5.5.4.3. The requested matrix of effects appears in the summary sections of Chapters 4, 5, 9, and 10.

Comment: Environmental Justice Issues Adversely Impact Claiborne County's Radiological Emergency and Security Response Capabilities. The DEIS states "It is not clear how the new nuclear facility would be treated for property tax purposes, so it is not clear whether Claiborne County would receive property taxes, sales, and use taxes and public monies commensurate with the cost of its additional emergency management and public service obligations. The net financial burden may fall on local residents and taxpayers, most of whom are minority and low-income persons. NIRS contends that the NRC finding that a predominantly African American community (84%) with a significant portion living at or below the poverty line (32%) could be disproportionately and adversely impacted by the siting of a new nuclear power station in context of a peculiar Mississippi State Tax Code which discriminates against the population of Claiborne County by distributing 70% of the property tax assessment of any nuclear power generating facility to 44 other Mississippi counties in Entergy's distribution system. This staff finding underscores the NIRS prior finding that Entergy's Environmental Report fails to evaluate the economic impacts on Claiborne County by imposing additional and undue financial burdens on the County for emergency preparedness affecting effective public notification, sheltering and evacuation, local law enforcement response capabilities to both an radiological accident or intentional act of sabotage and/or attack and the consequential radiological emergency response by local and county medical authorities. This burden to the public health, safety and security would be exacerbated by an additional commercial nuclear power state under the state of Mississippi's discriminatory state tax code policy as acknowledged by the DEIS. Rather than discount this burden, NRC should reject the SERI application. The resulting economic burden is just as likely to translate into dysfunctional and inoperable emergency response and unavailable local law enforcement services or at best significantly inadequate support in increased security needs of the expansion of the Grand Gulf nuclear power station site. The SERI application should therefore be rejected. (AR-6)

Comment: Time want [won't] permit me to further go into a depth discussion of the Affected Environment; however, based upon the in lieu of the payment of county, municipal, and district ad valorem taxes, the first grand gulf nuclear power plant pays the State Tax Commission a sum based on the assessed value of the nuclear generating plant, and are thereby distributed. This distribution of in lieu payment is Racist, and in fact Discriminates against the predominately Black Claiborne County. (AV-3)

Comment: Given the severity of the state of Mississippi misconduct, it would be unreasonable in the extreme for the United States Nuclear Regulatory Commission to overlook the obvious, and neglect to take appropriate measure to prevent further actual discrimination against the predominately Black Claiborne County in connection with the second Grand Gulf Nuclear Power Plant. (AV-4)

Response: *The analysis in the environmental impact statement of taxes (Sections 2.8.2.3, 4.5.3.2, and 5.5.3.2) discusses the conditions under which the governments and populace of Claiborne County and Port Gibson would benefit from additional tax receipts as a result of a new nuclear power plant being constructed and operated at the Grand Gulf early site permit site. Additional analysis has been conducted by the NRC staff since the draft EIS was issued which concludes that Claiborne County would receive at least $7.8 million in annual in-lieu-of-tax payments if a new facility were treated the same as the existing GGNS for tax purposes, and possibly much more if it were treated as an ordinary industrial asset. Section 5.7.3 discusses the potential adverse impact if (a) the local government were to receive only minimal revenue from a new plant and (b) there were a large increase in local population related to facility construction and operation. The U.S. Nuclear Regulatory Commission has no authority to control distribution of tax revenues from construction and operation of a commercial nuclear power facility. These comments did not result in a change to the environmental impact statement.*

Comment: Anyone that has this environmental impact statement, look on page 10.7 in Table 10.2 and see what it says about environmental justice issues. It essentially puts it off on the state and just wipes it off the slate, and that's a disgrace. I don't think there's any excuse for that. (G-8)

Response: *The comment has no specific recommendations for additional analysis. Detailed analysis supporting the summary conclusions in Chapter 10 is contained in Chapters 2, 4, 5, and 8. This comment did not result in a change to the environmental impact statement.*

Comment: According to this environmental impact statement, the first Grand Gulf nuclear power plant did nothing, absolutely nothing, to change and affect the minority and low income population, poverty, housing, medical and unemployment rate with the county, Claiborne County, where the first Grand Gulf nuclear power plant is located. (D-2)

Comment: This distribution of in-lieu payment is racist and, in fact, discriminates against the predominantly black Claiborne County. Now given the severity—given the severity of the state of Mississippi misconduct, it would be unreasonable in the extreme for the United States Nuclear Regulatory Commission to overlook the obvious and neglect to take appropriate measures to prevent further actual discrimination against the predominantly black Claiborne County in connection with the second Grand Gulf nuclear power plant. (D-3)

Comment: Environmental justice (EJ) is another issue of importance. Claiborne County is a low income area with the majority of the population being African-American. While the county has the highest risk from the dangers of the plant, the state tax structure is such that Claiborne County does not receive the majority of the taxes from the plant (pages 2-68 and 2-69). While table 10-2 (page 10-7) states that “adverse socioeconomic impacts could be disproportionate on local minority/low income community,” it also states that mitigation of this effect is not applicable because the problem is dependent on actions of the State. Rather than waiting to grant the ESP until this important issue is settled, the staff essentially “writes it off.” This is inexcusable. (AN-6)

Comment: Now I remember back when I was a boy, there were, you know, laundromats all around Philadelphia and Meridian where signs were up that said, Whites Only. And, you know, frankly, I don't see any difference between those signs in Philadelphia, and the fact that Claiborne County is peculiarly singled out and it's 84 percent African American population to subsidize the electricity from the Grand Gulf Nuclear Power Station. (H-2)

Comment: Charges of environmental racism will be injected into these proceedings. We believe the charge is inaccurate and unfair. Entergy owns and operates nuclear plants in many locations that are not in minority communities. Moreover, the mayor of Port Gibson, the county supervisor and the Entergy vice president at Grand Gulf (George A. Williams), and

Congressman Bennie Thompson are all African-American and support a new plant. The elected representatives of the area populations clearly have the best interests of their constituents in mind. They are not racists. City aldermen and the County Board of Supervisors also support a new plant. Although we do not have exact numbers, anecdotal evidence suggests that many African American residents in Port Gibson and Claiborne County want the project.

The African American Environmentalist Association supports the new unit or units and we are an African American-led environmental organization. We would not support the ESP if we believed it was a racist proposal. Our long history of fighting environmental injustice qualifies us to conclude that the project is not racist. The project will benefit African American communities in Port Gibson, Claiborne County, the state of Mississippi and African American communities downwind of the facility in the Eastern part of the United States. (AW-3)

Response: *The focus of an environmental justice review under the Commission's Policy Statement on the Treatment of Environmental Justice Matters in U.S. Nuclear Regulatory Commission Regulatory and Licensing Actions (69 FR 52040) is on identifying and weighing disproportionately significant and adverse environmental impacts on minority and low-income populations that may be different from the impacts on the general population. It is not a broad ranging or even limited review of allegations of racial discrimination. These comments provide no new information and did not result in a change to the environmental impact statement.*

Comment: The ROI is the geographical area considered in searching for candidate ESP sites. (AAEA [African American Environmental Association] concurs with the NRC staff findings that the impacts of a new unit or units at the River Bend site on minority and low-income populations would be SMALL. No adverse or disproportionately high impacts were identified. The city of Port Gibson and the residents of Claiborne County should be aggressively petitioning SERI to build the plant in their jurisdiction. There is no ironclad guarantee that the Grand Gulf location will be the site of the new plant. Stakeholders should be aware that the competitive climate for new nuclear facilities is increasing. (AW-7)

Response: *The comment provides no new information for additional analysis. This comment did not result in a change to the environmental impact statement.*

Comment: Claiborne County has higher than average poverty levels. The additional reactor would certainly provide more jobs to this impoverished area, but at a great cost. The money made could easily vanish to high medical bills later in life as the result of possible radiation exposure. (X-2)

Response: *The health consequences of normal operations and accidents are discussed in Sections 5.8, 5.9, and 5.10. Although these impacts are shown in terms of exposure and* *deaths due to cancer in the population rather than morbidity due to exposure, the effects shown are very small and likely mean that incidence of illness due to possible radiation exposure also would be very small. This comment did not result in a change to the environmental impact statement.*

Comment: “Environmental Justice:” A new reactor could unfairly burden minorities and low-income populations, which have a disproportionately high representation in Claiborne County. According to the 2000 United States Census, Claiborne County is 84.1 percent African American, compared to 12.3 percent nationally; and 32.4 percent of individuals live below the poverty level, compared to 9.2 percent nationally. The National Association for the Advancement of Colored People (NAACP) has asked SERI to withdraw its ESP application over environmental justice concerns, and the Claiborne County Chapter of the NAACP has passed a resolution opposing the project. The local chapter of the NAACP was also a party to a petition to the NRC (along with Public Citizen, the Nuclear Information and Resource Service, and the Mississippi Chapter of the Sierra Club) to intervene in the licensing proceeding for the Grand Gulf ESP, proffering a contention that SERI’s application did not adequately consider disproportionate adverse impacts on minority and low-income communities—the essence of the “environmental justice” issue—that might result from the project. Under the NRC’s expedited licensing process and revised environmental justice policy, the petition was rejected. The draft EIS acknowledges the high concentration of minority and low-income persons around the GGNS (§ 2.10) and considers the possibility that a new reactor may not provide an economic benefit to the community (§ 5.7.3), but ultimately concludes that operation of a new reactor would produce only “minimal negative and disproportionate health impacts on minority and low-income members of the public” (pg. 5-41). Such a conclusion does not consider the increased risk of adverse health impacts from a nuclear accident at the GGNS that would be endured by the nearby residents were an additional reactor constructed. (AM-16)

Comment: A new reactor could unfairly burden minorities and low-income populations, which have a disproportionately high representation in Claiborne County. The draft EIS acknowledges the high concentration of minority and low-income persons around Grand Gulf and considers the possibility that a new reactor may not provide an economic benefit to the community, but ultimately concludes that operation of a new reactor would produce only “minimal negative and disproportionate health impacts on minority and low income members of the public.” Such a conclusion does not consider the increased risk of adverse health impacts from a nuclear accident at Grand Gulf that would be endured by the nearby residents were an additional reactor constructed. (BB-3, BD-3, BG-3, BJ-4, BK-2, BL-3, MM-3)

Comment: The plant will be 1 mile from the Mississippi & there is insufficient discussion of security for the plant & the river. Since the attacks in London security should be even more of a concern. There are many minorities & poor people in the area & they can’t afford to pick up the tab for security. (BF-4)

Comment: A new reactor could unfairly burden minorities and low-income populations, which have a disproportionately high representation in Claiborne County. The draft EIS acknowledges the high concentration of minority and low-income persons around Grand Gulf and considers the possibility that a new reactor may not provide an economic benefit to the community. Somehow the draft EIS concludes that operation of a new reactor would produce only "minimal negative and disproportionate health impacts on minority and low-income members of the public." Such a conclusion does not consider the increased risk of adverse health impacts from a nuclear accident at Grand Gulf that would be endured by the nearby residents were an additional reactor constructed. (BH-3)

Comment: As always, here is environmental racism, with the EIS acknowledgment of a high concentration of minority and low-income persons around Grand Gulf. The "minimal negative and disproportionate health impacts on minority and low-income members of the public" is too much, besides which the danger of a nuclear accident isn't even addressed. (BI-2)

Response: *The impacts of accidents on offsite populations are discussed in Section 5.10. The probability-weighted impacts of postulated accidents would be SMALL for any of the potential advanced light water reactor technologies for offsite populations if constructed and operated at the Grand Gulf early site permit site. Section 5.10 concludes that the potential dose rates are still much lower than with current generation reactors and well within risk levels specified by Commission regulations and safety goals. This comment did not result in a change to the environmental impact statement.*

Comment: EJ & Public Involvement: Based on the DEIS, it is unclear to what extent the public is involved in the proposed project, particularly the EJ populations that reside in close proximity to the site, in addition to the populations that are within the area of potential effect. The DEIS does not discuss the relationship between local EJ populations and the existing nuclear reactor. For example, the document does not give information regarding: types of efforts made to incorporate the EJ populations throughout the decision-making process; evaluating whether the EJ populations that currently reside both in close proximity and within the sphere of potential effect have a good relationship with the existing facility; whether the existing facility has been a good neighbor; whether there [have] been any problems with [the] current facility which have generated public concern; whether residents in close proximity are employed by the nuclear facility; and whether local residents are supportive of the proposed expansion? If the residents have concerns, how are they being addressed? For example, the DEIS does not mention the legal challenge filed by a coalition of citizens groups objecting to the project, nor does the document mention any efforts to communicate with potentially impacted EJ communities to address their concerns. This information should be incorporated into the FEIS. (AZ-8)

Response: *The U.S. Nuclear Regulatory Commission scoping meetings are announced in the Federal Register, on the U.S. Nuclear Regulatory Commission website, in local and regional* *newspapers, with posters on public bulletin boards near the meeting location, and on local radio and television stations at least 1 week before the public meeting. The U.S. Nuclear Regulatory Commission requests the assistance of tribal, church, and community leaders to disseminate the information to potentially affected groups. Participants in the scoping process are provided an opportunity to submit oral comments at the scoping meeting and written comments through a project e-mail address or by regular mail. Specifically, in the case of the Grand Gulf early site permit, announcements of public meetings were made in the Jackson (Mississippi) Clarion-Ledger and Port Gibson (Mississippi) Reveille. Press releases announcing the meetings were forwarded to the Arkansas Democrat, the Columbus (Mississippi) Telegram, Jackson (Mississippi) Clarion-Ledger, Port Gibson (Mississippi) Reveille, and Vicksburg (Mississippi) Post newspapers, and to WJTV (Jackson) and WVUE-TV (New Orleans). In addition to scoping meetings, at the request of U.S. Nuclear Regulatory Commission staff, the local county governments invited a number of local government and social services officials to additional meetings that were held with staff in Port Gibson, Fayetteville, and Vicksburg. At these meetings, the relationships between the existing Grand Gulf Nuclear Station facility and the community were specifically discussed, as were conditions of the local hospital, emergency management plans and execution, staffing and equipment of emergency management agencies, tax effort, and tax distributions. The organizations contacted are listed in Appendix B of the environmental impact statement, and the attendees and substance of the meetings appear in the trip report available on the Internet (www.nrc.gov/reading-rm/adams.html) at Accession No. ML050350147. The impacts on public services are discussed in Section 5.5.4. Additional language has been included in Section 5.7 to describe the outreach process.*

Comment: The population living in the Grand Gulf region has long experienced elevated rates of poverty, unemployment, and lack of education. Moreover, it is a medically underserved area, placing it at increased health risk. (AT-6)

Response: *The U.S. Nuclear Regulatory Commission staff agrees with the commenter that the Grand Gulf region is an area with a high percentage of minority and low-income population. In addition, education attainment levels are low and unemployment rates are high relative to other parts of the state and the nation in Claiborne and Jefferson counties. The 2000 U.S. Census also indicates that average education levels of the adult population are lower in Claiborne County than in the state of Mississippi or the nation as a whole. A Mississippi Department of Public Health study in 2002 indicates that residents of Claiborne County obtain a significant proportion of hospital services in Vicksburg rather than locally (Berry, Spurlock, and Schmidt 2002), possibly indicating a limited level of service, a factor also commented on in Section 2.8.2.6 of the environmental impact statement. However, while in general these can be factors in increased health risk, mortality rates for Claiborne County residents and particularly for non-white residents are somewhat below corresponding rates in Mississippi as a whole and to some extent for the United States as a whole (see Section 2.10). The only significantly* *higher major cause of death in Claiborne County is accidents, not usually thought of as a pre-existing health risk. This comment did not result in a change to the environmental impact statement.*

Comment: I am also concerned that the DEIS does not seem to have considered the fact that our environment includes all the people and things around us. The people of Entergy have not seen fit to employ African Americans or Claiborne County residents in representative numbers at GGNS. The people of Entergy have not seen fit to provide the training (itself or working with neighboring Alcorn State University) that would qualify additional African Americans or Claiborne County residents for technical or professional jobs at the plant. So even if GGNS were a safe place to work, given the waste and accident or terrorism issues, the human part of the GGNS environment is counterproductive to the welfare of the majority of the residents of the area and therefore to all. (AO-4)

Response: *Pursuant to 10 CFR 51.71 and 51.90, the environmental impact statement includes an analysis of the socioeconomic impacts of facility construction and operation, including availability of workers within the region. Moreover, in its Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040), the Commission stated that "NRC believes that an analysis of disproportionately high and adverse impacts needs to be done as part of the agency's NEPA obligations to accurately identify and disclose all significant environmental impacts associated with a proposed action." In addition,*

> *as part of NEPA*'s *mandate, agencies are required to look at the socioeconomic impacts that have a nexus to the physical environment (see 40 CFR 1508.8 and 1508.14). An environmental-justice-related socioeconomic impact analysis is pertinent when there is a nexus to the human or physical environment or if an evaluation is necessary for an accurate cost-benefits analysis (see One Thousand Friends of Iowa v. Mineta, 250 F. Supp. 2d 1064, 1072 (S.D. Iowa 2002)).*

However, the Commission concluded in the Private Fuel Storage proceeding that failure to receive a benefit is not an adverse and disproportionate environmental impact:

> *In our view, the executive order [concerning environmental justice], and NEPA generally, do not call for an investigation into disparate economic benefits as a matter of environmental justice. Even though money (or social services) from the PFS lease payments might make it easier for some to tolerate noise, cultural insult, and unsightliness near the facility, the payments don't 'mitigate' environmental harms in the sense of eliminating or minimizing them. We see*

> *nothing in the executive order or in NEPA to suggest that a failure to receive an economic benefit should be considered tantamount to a disproportionate environmental impact.*

The provision of training local workers for jobs at the postulated facility is a desirable action if an applicant for a construction permit or a combined license should decide to undertake it and may reduce the number of workers that would be needed from outside the region of interest, but this is not required to mitigate an adverse environmental or socioeconomic impact.

The staff evaluated environmental impacts from construction (see Section 4.0), operation (Section 5.0), the uranium fuel cycle (Section 6.1), transportation of unirradiated fuel, spent fuel, and waste (Section 6.2), and decommissioning (Section 6.3). Regarding disposal of spent fuel, the U.S. Nuclear Regulatory Commission's Waste Confidence Rule, found in 10 CFR 51.23, states:

> *the Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.*

In its Statement of Considerations for the 1990 update of the Waste Confidence Rule (55 FR 38472), the Commission addressed the impacts of the disposal of spent fuel discharged from the current fleet of reactors (operating under existing and renewed licenses) and from a new generation of operating reactors. Therefore, the current rule covers new reactors and applies to the staff's review of an early site permit or combined license application. The rule was last reviewed by the Commission in 1999, when it reaffirmed the findings in the rule (64 FR 68005, dated December 6, 1999). Furthermore, the Atomic Safety and Licensing Board presiding over the Grand Gulf early site permit proceeding has affirmed that the Waste Confidence Rule and its subsequent amendments clearly include waste produced by a new generation of reactors (SERI 2004).

Finally, regarding security and terrorism, the Commission's position is that malevolent acts, including terrorism, are remote and speculative and, thus, beyond the scope of a National Environmental Policy Act of 1969 review (Private Fuel Storage, L.L.C. 2002). Comments related to security, safety, and emergency preparedness are out of scope with respect to the *environmental analysis. However, these topics are addressed in the staff's safety evaluation report. This comment did not result in a change to the environmental impact statement.*

Comment: EJ Assessment: Page 5-40, 5.7.1, states that "The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected." This statement needs clarification. Does it mean that there is no subsistence resource dependence at all, or that the resource dependency is not unusual? Given that there are significant EJ populations in an area rich in fishing and hunting resources, one would assume that subsistence practices do exist. Low-income populations with economic limitations are likely to conduct some subsistence practices to feed their families. Consequently, the FEIS should incorporate information and analysis that support the findings in the document. Please clarify the type of analysis that was performed to reach these findings. Were independent organizations, (e.g., a university experienced with this specialized capability of researching subsistence), utilized in this analysis, and were there public meetings held with subsistence living as a topic of discussion with potentially impacted EJ populations? This type of information should be incorporated into the document. Please summarize the basis for the information in these statements. (AZ-6)

Response: *The statement does not mean there are no resource dependencies, but rather that the staff did not discover any unusual resource dependencies during its scoping process, in its interviews with local officials, or in its search of the literature on this matter. The staff has reviewed a study that, while not specific to the Mississippi River near the Grand Gulf early site permit site, does describe a pattern of subsistence fishing among minority and low-income individuals in the general region that may also be relevant to the Mississippi River near the early site permit site. In addition, the staff has reviewed additional documentation on the general pre-existing health status of the minority population in the Claiborne County area. These data are now provided in Section 2.10 of the environmental impact statement, but did not result in any findings of disproportionate impacts on minority and low-income populations (Section 5.7.1). The local geographic intermixing of minority populations, low-income populations, white populations, and higher-income populations near the Grand Gulf early site permit site appears to be such that there would be no location-dependent disproportionate environmental impacts on minority and low-income populations. This comment resulted in a change to Sections 2.10 and 5.7.1.*

Subject: Groundwater Quality

Comment: Hydrological Monitoring, (pg 2-24), states that "many of the construction impacts of an ESP facility at the site are likely to be similar to the impacts that occurred during construction of the existing plant." The final EIS should include specific details of the expected "similar impacts" that were experienced and monitored due to the groundwater drawdowns caused by dewatering wells during the construction of the existing GGNS facility. (AZ-21)

Response: *Changes in drainage patterns from alterations to the site grade, increased potential erosion rates associated with exposed soils during site grading and excavation, and groundwater drawdown associated with dewatering and groundwater withdrawal are the primary impacts considered by the staff. No construction activities would be authorized under the proposed Grand Gulf early site permit. If an ESP is granted, a construction permit or combined license applicant would be required to follow current best management practices consistent with the terms of the National Pollutant Discharge Elimination System storm water construction permit that would be required prior to initiating any construction activities. Section 2.6.1.3 has been revised to include further mention of construction impacts and mention of the observed drawdowns at the site.*

Comment: Sole Source Aquifer: The GGNS uses wells in the Catahoula formation, part of the Southern Hills Aquifer, which has been designated by EPA as a sole-source aquifer, as a source of water. The DEIS states that the field investigation was unable to reliably assess the impact of a significant increase in the groundwater withdrawal at the site (page 4-6). The final EIS should clarify the water source, i.e., Mississippi River or Catahoula formation, that will be used for withdrawals such as drinking water, construction, operation, etc. (AZ-20)

Comment: Adequate hydraulic conductivity information from the Catahoula formation should be collected to properly determine or estimate the groundwater drawdowns associated with withdrawals from the formation, and this information should be included with the FEIS. In addition, a subsurface characterization along with a groundwater monitoring program, consistent with the detailed site design, should be submitted prior to issuance of the COL. (AZ-22)

Comment: An assessment of the impacts associated with significant increases in groundwater withdrawal at the site should be included based on a reliable number of borings, adequate hydraulic conductivity measurements, and pump test in the Catahoula formation. (AZ-23)

Comment: The Final EIS should include updated groundwater and surface water withdrawal use data, (agricultural, drinking water, mining, hydroelectric, thermoelectric, industrial, commercial, etc), in Claibome County. The data should be used to determine if the estimated need for this project would exceed or adversely impact the estimated needs of the community, in quality or quantity. (AZ-24)

Response: *Issuance of an early site permit for the Grand Gulf site would not authorize System Energy Resources, Inc. to perform any construction activities. Prior to initiating any construction activities for a new plant at the Grand Gulf site, an applicant referencing an ESP for the Grand Gulf ESP site would be required to obtain a construction permit or combined license from the U.S. Nuclear Regulatory Commission, except as provided in 10 CFR 50.10(e). At the construction permit or combined license stage, if the applicant were to choose to use* *water from the Catahoula formation, the applicant would be required to provide adequate information to allow the U.S. Nuclear Regulatory Commission to fully evaluate the impacts of groundwater withdrawals on the Catahoula formation. Prior to the issuance of a construction permit or combined license, the staff expects that an applicant would consult with the MDEQ regarding the impacts to Catahoula, which the U.S. Environmental Protection Agency has designated as a sole-source aquifer. If the construction permit or combined license applicant elects to pursue an alternate water source, the applicant would be required to provide adequate information to assess the impacts to any alternative water system that might be affected. These comments resulted in changes to Sections 4.3.2 and 5.3.2 of this environmental impact statement.*

Subject: Human Health - Nonradiological Impacts

Comment: Despite a finding by the National Institute of Environmental Health Sciences (NIEHS) that “extremely low frequency-electromagnetic field (ELF-EMF) exposure cannot be recognized as entirely safe” and may pose a leukemia hazard, the staff does not consider this to be a significant environmental impact to the public (EIS, § 5.8.4). Would a stronger electromagnetic field produced by increased voltage capacity on the transmission lines from the GGNS amplify this hazard? Further, SERI is allowed to wait until the COL licensing stage to determine whether transmission lines from the site meet the requirements of the National Electric Safety Code (NESC) regarding electrostatic effects from operation. Why is this issue not being addressed at this stage in the licensing process? (AM-25)

Response: *The proposed action is granting of an early site permit. This permit would not authorize construction or site preparation activities of any kind. If an early site permit is issued and the holder chooses to construct and operate a new nuclear facility at this site during the period of validity of the permit, an environmental impact statement would be required that would evaluate in depth all issues not considered or resolved in the impact assessment for the early site permit. The U.S. Nuclear Regulatory Commission staff would also evaluate any new and significant information pertaining to impacts analyzed in this environmental impact statement at the time it conducts an environmental review of an application for a construction permit or combined license referencing the proposed Grand Gulf early site permit. Issues not completely addressed in this environmental impact statement include construction and operation of new transmission capacity, which would be addressed at the construction permit or combined license stage as required by U.S. Nuclear Regulatory Commission regulations (10 CFR 51.70(b)). This comment did not result in a change to the environmental impact statement.*

Subject: Human Health – Radiological Impacts

Comment: The Commission has unduly trivialized and dismissed the increased risks to public health from radiation induced cancers and other radiation induced diseases from increased ionizing radiation emitted in the routine operational releases of liquid effluents and radioactive gases and particulates from new reactors at Grand Gulf. The DEIS ignores and is dated by the recent findings of the Biological Effects of Ionizing Radiation VII (BEIR VII) and National Academy of Sciences study. The DEIS states "Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses and dose rates, below about 100 mSv (10,000 mrem). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks. Based on this model, the staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv [1,000,000 person-rem]) from International Commission on Radiation Protection (ICRP) Publication 60 (ICRP 1990). This coefficient was multiplied by the estimated collective whole body population dose of 0.0543 person-Sv/yr (5.43 person-rem/yr) to calculate that the population living within 80 km (50 mi) of the Grand Gulf ESP site would incur a total of approximately 0.004 fatal cancers, nonfatal cancers, and severe hereditary effects annually. The risks from the cumulative radiation exposure from GGNS and the proposed ESP units would be only slightly higher. This risk is very small." (AR-7)

Response: *The draft environmental impact statement was published prior to the BEIR VII report being released; therefore, the staff did not ignore or trivialize the findings from the BEIR VII report. In fact, the BEIR VII report further supports the findings in the draft environmental impact statement. The environmental impact statement was revised to update the findings from BEIR V to BEIR VII. This comment resulted in a change to several sections of this environmental impact statement.*

Comment: Page 5-49, Line 26. The values in Table 5-6 are from Revision 0 of the SERI dose calculation vs. Rev. 3 (which incorporated X/Q values based on 2002-2003 met data). In most cases, the listed doses are conservative; however, the site boundary dose increased by ~90% instead of 14% as stated in the section directly above Table 5-6. The doses for all other locations decreased as stated in the text above Table 5-6. There also are some rounding errors in Table 5-6. (AP-20)

Comment: Page 5-55, Line 10. The results given in Table 5-9 do not agree with [the] latest SERI submittal; however, the dose rates listed for gaseous effluents are conservative relative to the latest results. The dose rates due to liquid effluents agree with [the] latest SERI submittal.

The total dose/Unit for Heron should be 1.95 instead of 1.96. Some of the total doses listed for Two Units do not reflect multiplying the single unit values by two (possible rounding or consideration of significant figures not shown). (AP-26)

Response: *The environmental impact statement was revised to incorporate the most current version of the System Energy Resources, Inc. environmental report. These comments resulted in a change to several sections of this environmental impact statement.*

Comment: In a paragraph about the "linear, no threshold" (LNT) model for estimating radiological impacts on human health, the NRC claims that "there are no data that unequivocally establish the occurrence of cancer following exposure to low doses and dose rates, below about 100 mSv" (EIS, pg. 5-52; repeated on pg. 6-32 and 6-36). Yet, as the U.S. Environmental Protection Agency (EPA) noted in comments in reference to an identical paragraph the draft EIS for an ESP at Exelon's Clinton Power Station in Illinois, the information presented here is "misleading at best." The EPA cites studies supporting the LNT model by the National Academy of Sciences, the National Council on Radiation Protection and Measurement, and the International Commission on Radiological Protection. More recently, a new report by the National Research Council, the research body of the National Academies, reaffirmed the validity of the LNT model, not just as a tool for conservatively estimating the impacts of radiation, but as an accurate measure of the risks of radiation to human health. The government-sponsored panel of experts has concluded that even very low levels of ionizing radiation can cause DNA damage that may eventually lead to the development of cancer. "The scientific research base shows that there is no threshold of exposure below which low levels of ionizing radiation can be demonstrated to be harmless or beneficial," said Richard R. Monson, a professor of epidemiology at Harvard and the chair of the committee that produced the study. In light of the concurring body of research in support of the LNT model, the language in the EIS that appears to challenge the validity of the LNT model should be removed. (AM-8)

Response: *As stated in the environmental impact statement, the staff accepts the linear, no-threshold dose-response model. In its recent report (entitled "Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2) (National Research Council 2006), the BEIR VII Committee concluded that the current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between exposure to ionizing radiation and the development of cancer in humans. Having accepted this model, the staff does feel that this model is conservative when applied to workers and members of the public who are exposed to radiation from nuclear power plants. This is based on the fact that numerous epidemiological studies have not shown increased incidences of cancer at low doses. Some of these studies included: (1) the 1990 National Cancer Institute study (NCI 1990) of cancer mortality rates around 52 nuclear power plants, (2) the University of Pittsburgh study that found no link between radiation released during the 1979 accident at the Three-Mile Island nuclear power station and cancer deaths among residents, and (3) the 2001* *study performed by the Connecticut Academy of Sciences and Engineering that found no meaningful associations from exposures to radionuclides around the Haddam Neck nuclear power plant in Connecticut to the cancers studied. In addition, a position statement entitled "Radiation Risk in Perspective" by the Health Physics Society (revised August 2004) made the following points regarding radiological health effects: (1) Radiological health effects (primarily cancer) have been demonstrated in humans through epidemiological studies only at doses exceeding 5-10 rem delivered at high dose rates. Below this dose, estimation of adverse effect remains speculative. (2) Epidemiological studies have not demonstrated adverse health effects in individuals exposed to small doses (less than 10 rem delivered in a period of many years). This comment did not result in a change to the environmental impact statement.*

Comment: Anyone who is for this type of energy better read some history behind these plants and how many 10's of 1000's were/are sickened by the releases of these plants, and the nuclear waste that is already overflowing each reactor site. To even consider even building one, takes a person who has no heart and no soul as this waste is going to sicken and kill us for time eternal. (AA-2)

Comment: I would have liked to have seen a survey on the increased cancer cases since operation of GGNS began. A comparison to counties that are not in close proximity of a nuclear power plant to Claiborne County. If this information was included in the ESP, I did not see it. (AS-6)

Comment: Does the continued operation of the reactor represent a threat to public health? (AT-3)

Comment: In the first two years after Grand Gulf went critical, the fetal and infant death rates soared (compared to the two years before startup), while declining in the rest of the region and nation. Both whites and blacks were affected. (AT-11)

Comment: Effects of Continued Operation. While immediate health effects of radiation exposure are most likely to be observed in fetuses and infants, adults are also affected. Often there is a latency period of as much as several decades between initial exposure and disease onset. Because Mississippi and Louisiana had no incidence registries for cancer and other diseases before Grand Gulf I began operating, mortality data are used. For each of the five local counties, the death rate for all causes combined from 1981-82 (before startup) and 1989-98 (7-16 years after startup) rose, versus declines in the region and nation. (AT-12)

Response: *Some of the comments are not within scope of this environmental impact statement in that they address the existing reactor rather than the proposed action.*

Health effects from exposure to radiation are dose-dependent, ranging from no effect at all to death. Above certain doses, radiation can be responsible for inducing diseases such as leukemia, breast cancer, and lung cancer. Very high (hundreds of times higher than a rem), short-term doses of radiation have been known to cause prompt (or early, also called "acute") effects, such as vomiting and diarrhea, skin burns, cataracts, and even death. When radiation interacts within the cells of our bodies, several events can occur. First, the damaged cells can repair themselves and permanent damage does not result. Second, the cells may die, much like large numbers of cells do every day in our bodies, and dead cells may be replaced through normal biological processes. Third, the cells may either incorrectly repair themselves (resulting in a change in the cells' genetic structure), they can mutate and subsequently be repaired without any effect, or they can sometimes form precancerous cells that may become cancerous.

Radiation is only one of many agents with the potential for causing cancer, and cancer caused by radiation cannot be distinguished from cancer attributable to any other cause, such as chemical carcinogens. The chances of getting cancer from a low dose of radiation is not known precisely because the few effects that may occur cannot be distinguished from normally occurring cancers. The normal chance of dying from cancer is about one in five.

The actual amount of radiation any member of the public receives from activities at nuclear power facilities is so small that scientists have been unable to make empirically based estimates of radiation risk with any precision. There are many difficulties involved in designing research studies that can accurately measure the projected small increases in cancer cases that might be caused by low exposures to radiation when compared to the rate of cancer resulting from all other causes. In the absence of a clear answer, the U.S. Nuclear Regulatory Commission conservatively assumes that any amount of radiation may pose some risk for causing cancer or having some hereditary effect and that the risk is higher for higher radiation exposures. This is called a linear, no-threshold dose-response model and is used to describe the relationship between radiation dose and the occurrence of cancer.

This model suggests that any increase in dose above background levels, no matter how small, results in an incremental increase in risk above existing levels of risk. Although the U.S. Nuclear Regulatory Commission has accepted this hypothesis as a "conservative" (i.e., cautious) model for determining radiation standards, the U.S. Nuclear Regulatory Commission , like other authoritative bodies, recognizes that this model will probably over-estimate radiation risk. The associations between radiation exposure and the development of cancer are mostly based on studies of populations exposed to relatively high levels of ionizing radiation (for instance, the Japanese atomic bomb survivors and the recipients of selected diagnostic or therapeutic medical procedures).

Although radiation can cause cancers at high doses and high dose rates, currently there are no data to establish unequivocally the occurrence of cancer following exposures to doses below *about 10 rem. The average annual dose to a member of the public from a nuclear power facility is in the range of less than 1/1000th rem (1 millirem) per year. This is compared to the 10 rem (10,000 millirem) discussed previously. At doses above 10 rem, a relationship between radiation and cancer can be observed. There are no data to establish unequivocally the occurrence of cancer following exposures to doses below 10 rem. Although there is a statistical chance that radiation levels that small (i.e., less than 10 rem) could result in a cancer, it has not been possible to calculate with any certainty the probability of cancer induction from a dose this small. Because many agents cause cancer, it is often not possible to say conclusively whether the cancer was radiation-induced cancer.*

Authors of various reports have stated or implied that there are cause-and-effect relationships in the statistical associations between cancer rates and reactor operations. While it is true that cancer rates vary among locations, it is very difficult to ascribe the cause of a cluster of cancers to some local environmental exposure, such as radiation from a nuclear power facility. Statistical association alone does not prove causation, and well-established scientific methods must be used to determine causation. For example, a person could say, "In the winter I wear boots, and in the winter I get colds." While there is a strong statistical association between wearing boots and getting colds, it would be inappropriate to say that wearing boots causes colds.

The scientific community adheres to several principles of good science that need to be employed before a cause-and-effect claim can be made. These principles include whether the study can be replicated, whether it has considered all the data or was selective (e.g., in the population or in the years studied), whether it evaluated all possible explanations for the observations, whether the data were valid and reliable, and whether the conclusions were subjected to independent peer review, evaluation, and confirmation.

A number of studies that conformed to these principles have been performed to examine the health effects around nuclear power facilities.

- *In 1990, at the request of Congress, the National Cancer Institute conducted a study (NCI 1990) of cancer mortality rates around 52 nuclear power plants and 10 other nuclear facilities. The study covered the period from 1950 to 1984 and evaluated the change in mortality rates before and during facility operations. The study concluded there was no evidence that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers in populations living nearby.*

- *Investigators from the University of Pittsburgh found no link between radiation released during the 1979 accident at the Three-Mile Island nuclear station and cancer deaths among nearby residents. Their study followed more than 32,000 people who lived within 8 km (5 mi) of the facility at the time of the accident.*

- *In January 2001, the Connecticut Academy of Sciences and Engineering issued a report on a study around the Haddam Neck nuclear power plant in Connecticut and concluded that exposures to radionuclides were so low as to be negligible and found no meaningful associations to the cancers studied.*

- *In 2001, the American Cancer Society concluded that, although reports about cancer clusters in some communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere in the population. Likewise, there is no evidence linking the isotope strontium-90 with increases in breast cancer, prostate cancer, or childhood cancer rates.*

- *In 2001, the Florida Bureau of Environmental Epidemiology reviewed claims that there are striking increases in cancer rates in southeastern Florida counties caused by increased radiation exposures from nuclear power plants. However, using the same data to reconstruct the calculations on which the claims were based, Florida officials did not identify unusually high rates of cancers in these counties compared with the rest of the state of Florida and the nation.*

- *In 2000, the Illinois Public Health Department compared childhood cancer statistics for counties with nuclear power plants to similar counties without nuclear plants and found no statistically significant difference.*

In summary, there are no studies to date that are accepted by the nation's leading scientific authorities that indicate a causative relationship between radiation dose from nuclear power facilities and cancer in the general public. The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. These comments did not result in a change to the environmental impact statement.

Comment: NIRS contends that new information provided by independent analysis in BEIR VII contradicts this NRC staff assertion: On June 29, 2005, the National Academies of Science released an over 700-page report on the risks from ionizing radiation. The BEIR VII or seventh Biological Effects of Ionizing Radiation report on "Health Risks from Exposure to Low Levels of Ionizing Radiation" reconfirms previous knowledge that there is no safe level of exposure to radiation—that even very low doses can cause cancer. Risks from low dose radiation are equal or greater than previously thought. The committee reviewed some additional ways that radiation causes damage to cells. Among the report's conclusions are: There is no safe level or threshold of ionizing radiation exposure. Even exposure to background radiation causes some cancers. Additional exposures cause additional risks. Radiation causes other health effects such as heart disease and stroke, and further study is needed to predict the doses that result in these non-cancer health effects. It is possible that children born to parents that have been exposed to radiation could be affected by those exposures. The "bystander effect" is an additional, newly recognized method by which radiation injures cells that were not directly hit but are in the vicinity of those that were. "Genomic instability" can be caused by exposure to low doses of radiation and according to the report "might contribute significantly to radiation cancer risk." These new mechanisms for radiation damage were not included in the risk estimates reported by the BEIR VII report, but were recommended for further study. The Linear-No-Threshold model (LNT) for predicting health effects from radiation (dose-response) is retained, meaning that every exposure causes some risk and that risks are generally proportional to dose. The Dose and Dose-Rate Effectiveness Factor or DDREF which had been suggested in the 1990 BEIR V report to be applied at low doses, has been reduced from 2 to 1.5. That means the projected number of health effects at low doses are greater than previously thought. Radiation exposures, even at low doses are riskier than previously thought with increased risk to the public and nuclear workers. The BEIR VII risk numbers indicate that about 1 in 100 members of the public would get cancer if exposed to 100 millirads (1milliGray) per year for a 70-year lifetime. This is essentially the U.S. Nuclear Regulatory Commission's allowable radiation dose for members of the public. In addition, 1 in about 5 workers would get cancer if exposed to the legally allowable occupational doses over their 50 years in the workforce. These risks are much higher than permitted for other carcinogens. Specifically, the U.S. Nuclear Regulatory Commission allows members of the public to get 100 millirems or mr (1 milliSievert or mSv) per year of radiation in addition to background. The BEIR VII report (page 500, Table 12-9) estimates that this level will result in approximately 1 (1.142) cancer in every 100 people exposed at 100 mr/yr which includes 1 fatal cancer in every 175 people so exposed (5.7 in 1000). This rate of cancer induction is significantly greater than projected by the DEIS. BEIR VII purports that the risk of getting cancer from radiation is increased by about a third from current government risk figures. BEIR VII estimates that 11.42 people will get cancer if 10,000 are each exposed to a rem (1,000 millirems or 10 mSv). The U.S. Environmental Protection Agency Federal Guidance Report 13 estimates that 8.46 people will get cancer if 10,000 are each exposed to a rem. NIRS interprets this as further evidence that unnecessary radiation exposures to the public and nuclear workers should be avoided. (AR-8)

Response: *The National Academy of Sciences published the BEIR VII report. Although there have been some releases that have stated it, the BEIR VII Summary report (National Research Council 2006) makes no such assertion that there is no safe level of exposure to radiation. The conclusions of the report are specific to estimating cancer risk. It does not address "safe or not* *safe." In the Executive Summary there is a quote: "In general the magnitude of estimated risks for total cancer mortality of leukemia has not changed greatly from estimates provided in past reports such as BEIR V and recent UNSCEAR and ICRP reports." The National Academies' "Report in Brief," June 2005, states, "In general, BEIR VII supports previously reported risk estimates for cancer and leukemia, the availability of new and more extensive data have strengthened confidence in these estimates." There is no statement about "no safe level or threshold." However, there is this statement: "BEIR VII Committee said that the higher the dose, the greater the risk; the lower the dose, the lower the likelihood of harm to human health." Regarding Mr. Gunter's statement, "Radiation causes other health effects such as heart disease and stroke, and further study is needed to predict the doses that result in these non-cancer health effects," the Summary further elaborates: "The Committee maintains that other health effects, such as heart disease and stroke, occur at high radiation doses but that additional data must be gathered before an assessment of any possible dose response can be made of connections between low doses of radiation and non-cancer health effects." Although the LNT is still considered valid, the conclusion from the Committee is:*

> *The BEIR VII Committee concludes that the current scientific evidence is consistent with the hypothesis that there is a linear dose-response relationship between exposure to ionizing radiation and the development of radiation-induced solid cancers in humans. The Committee further judges that it is unlikely that a threshold exists for the induction of cancers BUT NOTES THAT THE OCCURRENCE OF RADIATION-INDUCED CANCERS AT LOW DOSES WILL BE SMALL." [Emphasis added].*

The environmental impact statement was revised to update the findings from BEIR V to BEIR VII. This comment resulted in a change to several sections of this environmental impact statement.

Comment: Has introducing the reactor affected local public health? (AT-1)

Comment: Like any other nuclear reactor, Grand Gulf routinely emits fission products into the local environment. This radioactivity enters the air and food chain, and is taken up into human bodies through breathing and the diet. Several important facts that affect radioactive emissions and exposures to local residents should be considered. Grand Gulf lies far from any other nuclear reactor; thus, any documentation of potential radiation-related harm to public health is likely due to Grand Gulf, and not other reactors. (AT-4)

Comment: Public Health Impacts: On page 5-40, there is no reference to pre-existing studies on radiological and other contaminant findings in local fish and game. These studies probably exist for the Grand Gulf facilities, and should be incorporated into the FEIS. For example, Oak Ridge, TN and the Savannah River DOE facilities research findings on this subject matter, (and have restrictions placed on hunting deer, etc.). (AZ-11)

Response: *Section 2.5 describes the ongoing radiological environmental monitoring program (REMP) that has been conducted at Grand Gulf since 1978. Section 5.9 addresses exposure pathways from gaseous and liquid effluents. The staff believes that current regulations regarding environmental monitoring around nuclear power plants are adequate to protect the local public health. These regulations require each commercial reactor site to have a radiological environmental monitoring program. The purpose of the radiological environmental monitoring program is to sample, measure, analyze, and monitor the radiological impact of reactor operations on the following pathways – direct radiation, atmospheric, aquatic, and terrestrial. Results of the radiological environmental monitoring program are summarized each year in the Annual Environmental Radiological Operating Report. Effluent releases are summarized annually in an annual radioactive effluent release report. In addition, each site must monitor gaseous and liquid effluent in real time. Effluent monitors will alarm if routine release levels are exceeded. These comments did not result in a change to the environmental impact statement.*

Comment: Page 5-49, Line 13-16. The DEIS states "Other parameters used as input to the GASPAR II program (including milk, meat, and vegetable production rates, meteorological data, population data, and consumption factors) are found in Tables 5.4-3 through 5.4-5 of the SERI environmental report (SERI 2003c)." Should reference Tables 5.4-3 through 5.4-7. (AP-19)

Response: *Section 5.9.2.2 of the environmental impact statement was changed to state that GASPAR II program inputs were found in Tables 5.4-3 through 5.4-7.*

Comment: What is skyshine from nitrogen 16? (AS-7)

Response: *In boiling water reactors, such as the currently operating Grand Gulf Reactor, nitrogen-16 is produced in the reactor and travels to the turbine with the stream. Nitrogen-16 emits 13 gammas with energy ranging from about 800 keV to 9 MeV. The two most common gammas are about 6.13 MeV at 67 percent and 7.12 MeV at 4.9 percent. When nitrogen-16 decays outside the containment building, some of the gamma radiation is reflected back to the ground by the atmosphere. This reflected radiation is referred to as skyshine. This comment did not result in a change to the environmental impact statement.*

Comment: The area near Grand Gulf is largely rural, and has incurred very little industrial pollution before the reactor's startup. (AT-5)

Comment: Another – people keep talking about what a clean source of energy nuclear energy is. And keep talking about the air and how if you can see the air, it's not good to breathe. But one thing that we also know is that you don't see radiation. It's – and it's the most lethal thing in the world to be exposed to. (N–3)

Response: *These comments do not provide new information for additional analysis. These comments did not result in a change to the environmental impact statement.*

Comment: Unfortunately, the April 2005 EIS makes only cursory remarks about these important issues, or completely ignores them. Moreover, no data are presented in the EIS about emission levels, environmental levels of radiation, and in-body radiation in the local area; and no data on changes in local health status are included. Without analyzing such information, any decision to approve or disapprove Entergy Nuclear's Early Site Permit application would be incomplete. (AT-10)

Comment: RPHP recommends that the Nuclear Regulatory Commission take the following steps. First, these data should be reviewed and understood. Second, more current data should be reviewed. Third, these trends should be compared with any information on environmental emissions and environmental levels of radioactivity near Grand Gulf. And fourth, the NRC should initiate a study of in-body radioactivity near Grand Gulf; RPHP is currently conducting the only such study near U.S. reactors, in which it measures Strontium-90 concentrations in baby teeth). We urge that these steps be taken before any decision on the application is reached. Only by doing so will a truly complete environmental impact assessment be made. (AT-13)

Response: *The comment is not within the scope of this environmental impact statement, in that it addresses the existing reactor rather than the proposed action. Section 5.9 addresses exposure pathways from gaseous and liquid pathways. The staff believes that current regulations regarding environmental monitoring around nuclear power plants are adequate to protect the local public health. These regulations require each commercial reactor site to have a radiological environmental monitoring program. The purpose of the radiological environmental monitoring program is to sample, measure, analyze, and monitor the radiological impact of reactor operations on the following pathways – direct radiation, atmospheric, aquatic, and terrestrial. Results of the radiological environmental monitoring program are summarized each year in the Annual Environmental Radiological Operating Report. Effluent releases are summarized annually in an annual radioactive effluent release report. In addition, each site must monitor gaseous and liquid effluent in real time. Effluent monitors will alarm if routine release levels are exceeded.*

With regard to in-body radiation, the U.S. Nuclear Regulatory Commission does not require or support the need for such measurements for several reasons. First, radioactive materials may *come from a variety of sources; therefore, determining that a certain radioactive material is in an individual does not necessarily mean that material came from any certain nuclear facility. Interpretation of measurements of radioactive materials in people is difficult unless one knows what each individual was exposed to, when the exposure occurred, and by what routes they occurred (ingestion, inhalation, etc.). Second, travel must be accounted for, since even a couple of days in a high-fallout area could swamp any effect of local exposures if inhalation were suspected to be a primary route. Finally, migration must be accounted for to interpret measurements, because people may have lived somewhere else for the better part of their lives. Also, substances in the human body are dynamic, not static. This includes radioactive and non-radioactive substances. The dynamic processes include intake of material; uptake to systemic circulation from the gastrointestinal tract, respiratory tract, or skin; translocation throughout the body system; retention over time; and elimination via excretion and radioactive decay. These comments did not result in a change to the environmental impact statement.*

Comment: Grand Gulf is a boiling water reactor. Historically, over 80% of emissions of iodine-131 and particulates have been released from boiling water reactors, even though they make up only about one third of U.S. reactors. (AT-8)

Response: *The comment is not within the scope of this environmental impact statement, in that it addresses the existing reactor rather than the proposed action. The comment does not provide new information and will not be evaluated further. This comment did not result in a change to the environmental impact statement.*

Comment: Has the aging of the reactor affected local public health? (AT-2)

Response: *The comment is not within the scope of this environmental impact statement, in that it addresses the existing reactor rather than the proposed action. The current application is for an early site permit for one or more postulated new reactors. It does not contain detailed design information and is not directly related to the existing reactor at the Grand Gulf site. Therefore, consideration of reactor aging is outside of the scope of this environmental impact statement. However, the current reactor has been and is operating within the U.S. Nuclear Regulatory Commission's regulations that are designed to protect the health and safety of workers, the public, and the environment. This comment did not result in a change to the environmental impact statement.*

Comment: Page 4-46, Line 1. The DEIS states that the maximum total body dose due to gaseous releases from GGNS Unit 1 are 0.13 mrem/qtr (0.0013 mSv/qtr) whereas the ESP ER (Section 4.5.4) states that the dose from gaseous releases is 1.32E-01 mrem/yr. (AP-13)

Response: *The environmental impact statement was changed to state that the Annual Radiological Effluent Release Report states that the maximum total body dose rate from airborne releases was 0.13 mrem/yr.*

Comment: Page 5-51, Line 30. The population dose listed in this section (5.43 person-rem/yr) does not agree with initial submittal results; however, as stated in this section, the revised population doses using 2002-2003 meteorological data and population distributions from the environmental report resulted in lower population doses. Therefore, the general conclusion given in this section is valid. (AP-24)

Comment: Page 5-51. Table 5-7 uses values from Revision 0 of the SERI dose calculation instead of Revision 2. Some of the listed values are higher and others are lower than the current results. (AP-23)

Response: *The environmental impact statement was revised to incorporate the most current version of the System Energy Resources, Inc. Environmental Report. These comments resulted in a change to several sections of this environmental impact statement.*

Subject: Land Use

Comment: For example, SERI states "Road improvement and construction projects... planned... will help ameliorate traffic problems associated with the proposed facility." The DEIS fails to recognize that this assumption is baseless considering that current road infrastructure (bridges and pavement) around Grand Gulf nuclear power station, including designated Emergency Evacuation Routes such as the Bald Hill Road which [is] south of the site, have [has] fallen into disrepair from Mississippi River flooding and remained impassible for as much as three to four consecutive years. (AR-2)

Response: *Bald Hill Road was washed out at Bayou Pierre, but has now been realigned and made passable. Additionally, the current plan is to remove the remaining blacktop (which is heavily potholed) and turn the road in the realigned section into gradable gravel, so that it is usable for emergency evacuation. In addition, the project for the extension of Highway 18 (known locally as the "Port Connector" project) has progressed substantially since the environmental report was written. The environmental impact statement for this project is now finished and early right-of-way acquisition has started. The 2005 federal highway bill contained a $10 million earmark for this project, which would provide improved direct access to the Grand Gulf site from the south and from Port Gibson along a path to the west of and parallel to Oil Mill Road. Construction is scheduled to start in 2006 and be completed in early to mid-2007. Section 2.8.2.2. has been revised to reflect this update.*

Subject: Need for Power

Comment: According to NRC regulations at 10 CFR 52.17(a)(2), the need for power does not have to be addressed in the ESP process. But an evaluation of the need for power and who benefits is crucial to determining whether the ESP application should be considered at all. In fact, the first question that should be asked is whether residents of Mississippi will receive any of the benefit of a new nuclear unit. SERI intends to operate its new facility as a "merchant nuclear plant, providing electrical energy to the competitive marketplace," an assertion unchallenged by the NRC (EIS, pg. 8-4). Unlike power generation under a regulated framework, merchant producers of electricity sell their power on the open market "to any buyer willing to pay the price asked by the facility owner" (EIS, pg. 8-4). This means that SERI is indifferent to the beneficiaries or recipients of its power generation, because its only concern is making profits from the sale of electricity. The final EIS should include an analysis of the exportation of electricity generated by the new nuclear unit at the GGNS to other states where electricity prices are higher and revenues will be greater for SERI. (AM-21)

Comment: The draft Environmental Impact Statement (DEIR) doesn't make it clear that the extra electric energy is needed. (BF-2)

Response: *According to U.S. Nuclear Regulatory Commission regulations at 10 CFR 52.18, the need for power does not have to be addressed in the early site permit process because no decision involving the need for power is being made. The filing of an application for an early site permit is a process that is separate from the filing of an application for a construction permit or a combined license for such a facility. The early site permit application makes it possible to evaluate and resolve some safety and environmental issues related to siting before the applicant makes large commitments of resources. If the early site permit is approved, the applicant can "bank" the site for up to 20 years for future reactor siting. The early site permit does not authorize construction or operation of a nuclear power plant. At the point when the early site permit holder believes that it wants to proceed with construction, it must obtain a construction permit or a combined license, which will be a major Federal action that requires a separate environmental impact statement that, among other things, addresses the need for power and cost of power. This comment did not result in a change to the environmental impact statement.*

Subject: NEPA Compliance

Comment: Page 10-7, Line 20-23. Commitment of Resources. "Because the proposed action therefore does not involve commitment of resources, a complete assessment of irreversible and irretrievable commitments of resources would be performed at the CP or COL stage if SERI is granted an ESP and later applies for a CP or COL." See also Ln. 30-31 ("The actual estimate of construction materials would be performed at the CP or COL stage when the reactor design is selected.") The staff appears to ignore SERI's ER Table 10.1-1 which addresses this issue. SERI urges the staff to conduct an evaluation based on ER data. (AP-35)

Response: *Because construction would not be authorized by an early site permit at the Grand Gulf early site permit site, resource commitments can only be discussed in a general framework. This level of analysis was performed in this environmental impact statement and impacts were found to be small. However, a final assessment of the costs and benefits and of any irreversible and irretrievable commitments of resources would be required at the construction permit or combined license stage. This comment did not result in a change to the environmental impact statement.*

Comment: Purpose & Need: The DEIS does not include an assessment of the energy needs for the addition of one or two nuclear power units at the Grand Gulf facility. NRC's streamlining permitting process would require an energy needs analysis which would include energy alternatives assessment in a second EIS, in accordance with 10 CFR Part 50. EPA has concerns with this approach since it does not address the justification for the power plant addition in the early stage of project development, as well as skews the subsequent energy alterative analysis toward nuclear power under the second EIS, since the NRC would have approved the suitability under the ESP. (AZ-1)

Response: *U.S. Nuclear Regulatory Commission regulations (10 CFR 52.18) regarding preparation of environmental impact statements for early site permit applications state that the impact statements need not include an assessment of the benefits of the proposed action, including need for power. Analysis of benefits arising from construction and operation of a new nuclear power facility, including need for power, would be required should an ESP holder pursue construction through a construction permit or a combined license application, in accordance with 10 CFR 52.39 and 52.89. As stated in the environmental impact statement and in 10 CFR 52 Subpart A, the issuance of an early site permit does not authorize construction of a new nuclear unit, which is a separate licensing action requiring its own environmental analysis. In the case of the Grand Gulf early site permit, no construction or site preparation of any kind would be allowed under this permit. This comment did not result in a change to the environmental impact statement.*

Comment: If NEPA does not require a review of terrorism in the EIS, then NEPA should be modified or some other requirements need to be created. Certainly the devastating effects of a meltdown or severe accident involving nuclear waste should not be ignored in the EIS process. (AN-5)

Response: *Requests to modify the National Environmental Policy Act of 1969 or to enact new legislation should be directed to members of the U.S. Congress. Information on U.S. Nuclear*

Regulatory Commission's response to terrorist threats can be found at the following Internet site: http://www.nrc.gov/what-we-do/safeguards.html. The environmental impacts of nuclear fuel-cycle issues are discussed in Chapter 6 of the environmental impact statement. This comment did not result in a change to the environmental impact statement.

Comment: Page 10-8, Line 16-21. Relationship Between Short-Term Uses and Long-Term Productivity. The staff appears to ignore SERI's ER Section 10.3 which addresses this issue: "In accordance with 10 CFR 52.18, an EIS for an ESP does not need to include an assessment of the benefits of the proposed action. Therefore, an assessment of the evaluation of the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity for the construction and operation of a new nuclear unit would be performed at the CP or COL stage should SERI be granted an ESP and later seek a CP or COL." SERI urges the staff to conduct an evaluation based on ER data. (AP-36)

Response: *Section 102(2)(C)(iv) of the National Environmental Policy Act of 1969 requires that an environmental impact statement address the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. This subject is addressed in Section 10.3 of the environmental impact statement. Section 10.3 of System Energy Resources, Inc.'s environmental report discusses the benefits of construction and operation of a new facility at the early site permit site. As stated in Section 10.3 of the environmental impact statement, the U.S. Nuclear Regulatory Commission would address the benefits of the proposed action and long-term productivity in an environmental impact statement prepared by the staff at the construction permit or combined license stage should System Energy Resources, Inc. be granted an early site permit and later seek a construction permit or combined license. This comment did not result in a change to the environmental impact statement.*

Comment: The draft EIS fails to adequately execute the requirements of the National Environmental Policy Act (NEPA) by not adequately providing a "detailed statement" of (1) alternatives to the proposed action, (2) unavoidable environmental impacts, (3) irretrievable commitments of resources, and (4) the relationship between short-term uses of the environment and long-term productivity [42 U.S.C. § 4332(C)]. Instead of a thorough evaluation, these issues receive only brief, perfunctory attention in Chapter 10 of the draft EIS, and the NRC staff is almost glib in dismissing energy conservation as a reasonable alternative to the proposed action (EIS, pg. 8-5). (AM-6)

Response: *The environmental impact statement includes a detailed discussion of alternatives in Chapter 8. Chapter 10 of the environmental impact statement discusses unavoidable adverse impacts, irreversible and irretrievable commitments of resources, and the relationship between short-term uses and long-term productivity of the human environment. This comment did not result in a change to the environmental impact statement.*

Comment: Future planning: The 20-year horizon under the proposed ESP does not take into consideration unforseen population growth and/or additional stressors on air or water resources. Typically, an action which has not occurred within five years of an EIS requires a re-evaluation to determine whether significant changes have occurred, and whether a supplemental EIS is required prior to the action proceeding. (AZ-4)

Response: *The proposed action is granting of an early site permit. This permit would not authorize construction or site preparation activities of any kind. If an early site permit is issued and the holder chooses to submit an application to construct and operate a new nuclear facility at this site during the period of validity of the permit, an environmental impact statement would be prepared by the U.S. Nuclear Regulatory Commission that would evaluate in depth all issues not considered or not resolved in the impact assessment for the early site permit. This would include all new and significant information for issues addressed in the impact assessment for the early site permit that have arisen between the time of the issuance of the early site permit and the application for a license for construction/operation. This comment did not result in a change to the environmental impact statement.*

Subject: Opposition to NRC's ESP Process

Comment: I also see a problem – well, let me say that in this document, there are 14 pages of assumptions in the information provided by SERI. And that's a lot of assumptions. It would be nice to have some hard data. (G-3)

Response: *Assumptions used by the applicant and the U.S. Nuclear Regulatory Commission staff are included as part of the environmental impact statement to document the bases for the analyses and the aspects of the applicant's plant parameter envelope that pertain to the conclusions drawn regarding impact. The U.S. Nuclear Regulatory Commission's process for early site permit applications is set forth in 10 CFR Part 52 Subpart A. Requirements for the applicant's environmental report are specified in 10 CFR 51.45 and 10 CFR 52.17. As stated in 10 CFR 51.41 and 52.18, U.S. Nuclear Regulatory Commission staff is required to conduct an independent assessment of the information and conclusions provided in the environmental report. Reasonable assumptions are commonly made and documented in such analyses. This comment did not result in a change to the environmental impact statement.*

Comment: Allow Claiborne County citizens to voice comments directly after the NRC presentation. We should not have been subjected to the ramblings (even though some of the comments were good) of watchdog groups, minority issue groups, and SERI employees. Most of those people were paid to be there. I understand that this meeting was for the public. But the people of Claiborne County should have been given the opportunity to speak first because this decision affects us the most. (AS-2)

Response: *Following the staff's presentation, the order of speakers at U.S. Nuclear Regulatory Commission public meetings is generally the following: the applicant, elected officials, and members of the public (both out-of-town and local) in the order they sign up to speak. This comment did not result in a change to the environmental impact statement.*

Comment: And I would like to echo Paul's request that there be more opportunities like this one, not just here in Port Gibson, although this is obviously an important place to do it, but this is not the only place that this reactor is going to have an effect. (I-1)

Response: *The U.S. Nuclear Regulatory Commission has limited resources to conduct public meetings that are not mandated by statutory requirements. However, because the staff recognizes the importance of public outreach and direct involvement in the conduct of its environmental reviews, public meetings are generally held at the site, at U.S. Nuclear Regulatory Commission headquarters, or sometimes both. Commenters also have the option of submitting comments by mail or e-mail. This comment did not result in any change to the environmental impact statement.*

Comment: The various NRC speakers and their advanced educational degrees were quite impressive, but, a little intimidating to the average Joe. I'm not illiterate, but would feel much more relaxed voicing concerns to people like us. I believe that a less formal meeting, without cameras and microphones, would have provided a better atmosphere. I feel the people of Claiborne County would benefit greatly from such a meeting. (AS-4)

Response: *U.S. Nuclear Regulatory Commission staff and U.S. Nuclear Regulatory Commission contractor personnel were made available to discuss, on an informal basis, issues and concerns related to the Grand Gulf early site permit application immediately prior to and after the public scoping meeting and the public meeting on the draft environmental impact statement. U.S. Nuclear Regulatory Commission public meetings are necessarily somewhat formal to ensure that speakers are heard and their comments are properly recorded. This comment did not result in a change to the environmental impact statement.*

Comment: I have to go now due to more pressing matters (breakfast). I do hope that the NRC continues to work for the health and safety of the public as my Claiborne County family of 4 is most definitely the affected public in this matter. (AS-9)

Response: *The U.S. Nuclear Regulatory Commission takes seriously its mission to protect the public health and safety and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities. This comment did not result in a change to the environmental impact statement.*

Comment: Applicant SERI Environmental Assessment is incomplete as identified by NUREG-1817 and therefore the permit application is unacceptable and should be rejected. Appendix J of the DEIS identifies an extensive list of assumptions made by applicant SERI in its environmental assessment report to the NRC. Applicant SERI has indicated that it will further address these assumptions in a Combined Operation License application. (AR-1)

Response: *System Energy Resources, Inc.'s early site permit application was amended several times to incorporate new information. Such amendments are allowed under the U.S. Nuclear Regulatory Commission's procedures. The final environmental impact statement reflects System Energy Resources, Inc.'s early site permit application as amended. Appendix J of the environmental impact statement lists System Energy Resources, Inc. commitments and assumptions that the staff relied upon during preparation of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: I also want to point out that the Nuclear Regulatory Commission is supposed to be unbiased, yet it states in this document at one point that this ESP – excuse me – this EIS was done based on NRC regulations and the Atomic Energy Act. And the Atomic Energy Act was written in the early 1950s to promote nuclear power. Now that is a real conflict of interest in my opinion. You're supposed to be regulating, you're supposed to be looking out for the public safety and you should not be using a document that was written to promote nuclear power. It was written in the 50s after World War II to promote the peaceful atom. So that needs to change. (G-7)

Response: *While the Atomic Energy Act of 1954 previously defined a role for the Atomic Energy Commission in formulating national energy policy, the Act, as amended in 1974 by the Energy Reorganization Act, formed the U.S. Nuclear Regulatory Commission from the Atomic Energy Commission's regulatory division to regulate the nuclear power industry. The Energy Reorganization Act segregated the Atomic Energy Commission's national policy role in the Energy Research and Development Administration, which later became the U.S. Department of Energy. The U.S. Nuclear Regulatory Commission has no role in promoting nuclear power. Rather, the Congress and the President establish the energy policy of the United States, and the U.S. Department of Energy implements that policy at the direction of the President.*

The U.S. Nuclear Regulatory Commission's process for early site permit applications is set forth in 10 CFR Part 52 Subpart A. Requirements for the applicant's environmental report are specified in 10 CFR 51.45, 51.50, and 52.17. U.S. Nuclear Regulatory Commission staff are required to conduct an independent assessment of the information and conclusions provided in the environmental report as specified by 10 CFR 51.41 and 52.18. This comment did not result in a change to the environmental impact statement.

Comment: And the first thing I noticed was that SERI provided a lot of the information for this document, and that the Nuclear Regulatory Commission, at some points, did an independent review, and at other points just accepted information provided by the utility that has a vested interest in getting this early site permit. And I see a real problem with that. (G-2)

Response: *The U.S. Nuclear Regulatory Commission's process for early site permit applications is set forth in 10 CFR Part 52 Subpart A. Requirements for the applicant's environmental report are specified in 10 CFR 51.45, 51.50, and 52.17. As stated in 10 CFR 51.41 and 52.18, U.S. Nuclear Regulatory Commission staff are required to conduct an independent assessment of the information and conclusions provided in the environmental report. In preparing the environmental impact statement, the staff used information supplied by System Energy Resources, Inc. in its application but conducted an independent review and analysis. System Energy Resources, Inc. submitted its early site permit application under oath and affirmation that the application was true and correct. This comment did not result in a change to the environmental impact statement.*

Comment: The information contained in the Entergy's Draft Environmental Impact Statement (EIS), is incomplete and insufficient. In addition Entergy doesn't explain what it will do with all the nuclear waste in the long term, nor is the company required to address security issues. I understand that your rules do not require that but surely that's important information and your agency SHOULD require it and Entergy should provide that information. (AE-1)

Comment: While I do not want to put NRC employees out of work, I believe their skills could be better put to use evaluating alternative energy and dealing with the existing nuclear structures in our country. In conclusion, I encourage both Federal and State legislators and the Commissioners of the NRC to re-evaluate the entire ESP/EIS process and make the changes necessary to protect the public to the fullest. I also encourage them to promote the use of decentralized energy facilities and the use of alternative energy, and to do whatever is necessary to prevent the further accumulation of nuclear waste from energy production. (AN-13)

Response: *The U.S. Nuclear Regulatory Commission's process for early site permit applications is set forth in 10 CFR Part 52 Subpart A. Requirements for the applicant's environmental report are specified in 10 CFR 51.45, 51.50, and 52.17. U.S. Nuclear Regulatory Commission staff are required to conduct an independent assessment of the information and conclusions provided in the environmental report as specified by 10 CFR 51.41 and 52.18. Modification of the early site permit process cannot be accomplished as part of the environmental review, but can be proposed through the rulemaking procedures as described on the U.S. Nuclear Regulatory Commission's website (http://www.nrc.gov). These comments did not result in a change to the environmental impact statement.*

Comment: And what I feel about this document is that it's geared toward using the process for Entergy to build another nuclear reactor, and I don't think that that's in the best interest of Mississippi, or the country. (G-1)

Comment: I also feel that this is a lot of expense, a lot of taxpayer dollars, a lot of time spent, and really not a lot of information provided, and not a lot of real concrete decisions made, because all through this document they talk about not enough information was provided to make a decision. Not enough information was provided by SERI, by Entergy, there's constant references to that through here. And constant references to later assessments at the construction permitting process or the combined license. And I think for the resources, for the time of the staff, the financial resources that were put in here – as a taxpayer, I think you're wasting my money. (G-6)

Comment: And, you know, there are a number of issues that we could go into, but because of time and the fact that the public is only given one night to address an environmental impact statement that's been under construction for, you know, over a year, I, first of all, think that's a travesty that we're being bum's rushed out of this process, and it is of great concern, and I think reflects the kind of promotion that I have great concern for. (H-1)

Comment: But I would like you to think about, as Ruth pointed out, how many times you've heard tonight that this is an issue that's going to be postponed and addressed later, either at the COL, the construction and operating license stage, or maybe it's one of those issues that never has to be addressed at all, because there is no good answer for it. (I-2)

Response: *The U.S. Nuclear Regulatory Commission's process for early site permit applications is set forth in 10 CFR Part 52 Subpart A. Requirements for the applicant's environmental report are specified in 10 CFR 51.45, 51.50, and 52.17. U.S. Nuclear Regulatory Commission staff are required to conduct an independent assessment of the information and conclusions provided in the environmental report as specified by 10 CFR 51.41 and 52.18. Unresolved issues will be addressed at the construction or combined license stage. These comments did not result in a change to the environmental impact statement.*

Comment: NIRS contends that it is inappropriate and unacceptable to base the environmental assessment of the ESP EIS with so many open item assumptions. NIRS contends that it is therefore unacceptable for NRC to blindly approve the ESP application with the intent to carry these assumptions forward into the Combined Operation License application at some future and unidentified date. Such action makes the process of doing a comprehensive environmental assessment pointless. (AR-4)

Response: *The purpose of an early site permit is explained in Section 1.1 of the environmental impact statement. The staff's use of the plant parameter envelope in conducting its* *environmental review is explained in Section 3.2 of the environmental impact statement. If System Energy Resources, Inc. were to receive an early site permit from the U.S. Nuclear Regulatory Commission and decided to seek a construction permit or combined license, it would need to submit a specific design to the U.S. Nuclear Regulatory Commission as part of its application and the staff would analyze any issues not considered or resolved in another environmental impact statement. An early site permit does not authorize construction of a new nuclear power plant. This comment did not result in a change to the environmental impact statement.*

Comment: The meeting location, basically was the pits. It was hot, crowded and the slide presentation was basically useless because few people could see it. Also, the lighting was so poor that the hard copy slides were impossible to read. I don't know if it is allowable for a government agency to utilize churches, but that would have been the obvious choice of meeting places. Any of the churches on Church Street would have gladly opened their doors to such a cause. The only requirement would have probably been a benediction by the pastor at the beginning and end of the meeting. I personally think that would have been a great thing to have. (AS-3)

Response: *The staff seeks to choose the most suitable meeting location near the site of the proposed action possible to accommodate the public. This choice is sometimes difficult because it is not known in advance how many people will attend a meeting and what the weather conditions will be. This comment did not result in a change to the environmental impact statement.*

Comment: This siting's permitting and licensing process has been handled with as little public input and comment as the Nuclear Regulatory Commission has been able to get away with. Your hearing in Mississippi was set up at a time and place when most prospective intervenors and concerned citizens would be unable to make the hearing, or would have to take time away from work and family to come in and testify. Many concerned residents of Louisiana, Mississippi, and surrounding areas had to stay in Mississippi at least overnight on July 5th, in order to attend the hearing and testify, and return home the next day. Louisiana and Mississippi residents already have three nuclear power plants between them: River Bend, Waterford III, and Grand Gulf. Your agency's attempting to streamline the permitting and licensing process for this next nuclear power plant by curtailing public comment, by those who will be the most affected by this plant's operation, is unacceptable, and your decision to concentrate your permitting and licensing process in Washington, D.C., puts any meaningful input into these decisions effectively out of reach for those who are unable to come to Washington, D.C., due to their family or work responsibilities. (AI-2)

Response: *The staff sets meeting dates and times so as to be convenient for the public as well as the staff. The staff held two public meetings in Port Gibson, a public scoping meeting* *on January 21, 2004 and a public meeting on the draft environmental impact statement on June 28, 2005. Members of the public who cannot attend a public meeting have the opportunity to submit comments by mail or e-mail. Such written comments received the same attention from the staff as oral comments presented at a public meeting. The comment period for scoping was 60 days, while the period for comment on the draft environmental impact statement was 75 days. Modification of the early site permit process cannot be accomplished as part of the environmental review, but can be proposed through the rulemaking procedures as described on the U.S. Nuclear Regulatory Commission's website (www.nrc.gov). This comment did not result in a change to the environmental impact statement.*

Comment: I found the June 28, 2005 public meeting to be very well organized but to some extent scripted and orchestrated. The facilitators were courteous, professional and knowledgeable. This process is obviously complicated and difficult for private citizens to follow and understand. I suggest that technocrats be reminded that everyone does not have nuclear energy backgrounds and training, therefore, when speaking, they should use plain and simple language as well as analogies and examples and the least amount of technical talk as possible. (AQ-1)

Response: *The staff will consider this comment for conducting future public meetings. This comment did not result in a change to the environmental impact statement.*

Comment: Please have meetings start at 6 p.m. if at all possible. Especially if they are going to run so long. Most people from the country are in bed at 9 p.m. (AS-1)

Response: *The staff will consider this comment in setting future meeting times. It is difficult for the staff to know in advance how long a meeting will last. This comment did not result in a change to the environmental impact statement.*

Comment: So what does the Grand Gulf EIS say about the environmental impacts of these and certain other related matters? Very little of substance, I am afraid. Much of the analysis in the DEIS is based upon the nebulous assumptions that constitute the Plant Parameter Envelope rather than on specific design information. Additionally, many potential environmental impacts are not analyzed at all or the needed analysis is being postponed into the future or passed off to other Federal agencies such as the Federal Energy Regulatory Agency. This situation is clearly contrary to Section 102. (C) (iv) of the National Environmental Policy Act that requires all agencies of the Federal Government to describe in their Environmental Impact Statements "The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." Issuance of an Early Site Permit, based upon a set of nebulous assumptions and incomplete environmental analysis and for a situation where there is no clear long-term plan to deal effectively with radioactive waste disposal issues or issues involving potential terrorist acts and where there is no definitive plan on record or financial resources available to deal with a major disaster at the Grand Gulf site once new reactors are built is totally unreasonable and contrary to the public interest. The people of Mississippi and Louisiana and the Nation as a whole deserve more than this from their government. (AK-4)

Response: *The staff's use of the plant parameter envelope in conducting its environmental review is explained in Section 3.2 of the environmental impact statement. Additionally, the U.S. Nuclear Regulatory Commission's understandings and expectations regarding the use of the plant parameter envelope approach for the preparation and review of early site permit applications are discussed in a February 5, 2003, letter to the Nuclear Energy Institute. If System Energy Resources, Inc. were to receive an early site permit and decided to seek a construction permit or combined license, it would need to submit a specific design to the U.S. Nuclear Regulatory Commission as part of its application. The relationship between short-term uses and long-term productivity of the human environment is discussed in Section 10.3 of the environmental impact statement. Environmental impacts of radioactive waste disposal issues are discussed in Section 6.1.1.6 of the environmental impact statement. Information on security at nuclear power plants can be found on the U.S. Nuclear Regulatory Commission's Internet website at: http://www.nrc.gov/what-we-do/safeguards.html. An early site permit does not authorize construction of a new nuclear power plant. Modification of the early site permit process cannot be accomplished as part of the environmental review, but can be proposed through the rulemaking procedures as described on the U.S. Nuclear Regulatory Commission's website (http://www.nrc.gov). This comment did not result in a change to the environmental impact statement.*

Comment: Furthermore, for the ESP process to work, the DEIS would need to show a 20 year forecast for all conditions as a baseline condition atop which the proposed project would need to be an overlay. (BL-2)

Response: *The comment provides no new information. This comment did not result in a change to the environmental impact statement.*

Subject: Opposition to Nuclear Power

Comment: In reality, I am commenting due to the continued failure of our Federal Government, and, in particular, the Bush Administration, to promote the general welfare of its citizens. (AK-1)

Response: *U.S. Nuclear Regulatory Commission's regulations implementing safe use of nuclear energy have been issued as 10 CFR Parts 1 to 199. This comment did not result in a change to the environmental impact statement.*

Subject: Opposition to the Licensee or Licensee's Application

Comment: The very last thing we need on this earth is another nuclear power plant. (AA-1)

Response: *The comment provides no new information for additional analysis. This comment did not result in a change to the environmental impact statement.*

Comment: I oppose the next Grand Gulf nuclear power plant in Port Gibson, Mississippi. No matter how "safe" these nuclear power plants are, how well-built they are, or how supposedly important they are in the efforts to reduce global warming and greenhouse gases, they have two aspects that no amount of pro-nuclear power advocacy can ever diminish: they will always be sited in low-income, minority communities, and they always produce radioactive waste with a 10,000-year half-life. (AB-1)

Comment: I flatly reject the argument that increased investment in nuclear capacity is an acceptable or necessary solution. (AC-1)

Comment: Using Nuclear Power to Address Climate Change Would Exacerbate the Problems: Major studies, such as those by MIT, agree that using nuclear power to have any significant effect on climate change would require building at least 1,000 new reactors worldwide. This would exacerbate all of the problems of the technology: more terrorist targets, more cost (potentially trillions of dollars), less safety, need for a new Yucca Mountain-sized waste site every 4 or 5 years, more proliferation of nuclear materials and technologies, dozens of new uranium enrichment plants, and even then, a severe shortage of uranium even within this century--while displacing the resources needed to ensure a real solution to the climate change issue. (AC-8)

Comment: Conclusion: I believe that the financial and safety risks associated with nuclear power are so grave that nuclear power should not be a part of any solution to address global warming. There is no need to jeopardize our health, safety and economy with increased nuclear power when we have cleaner, cheaper solutions to reduce global warming pollution. (AC-9)

Comment: I'd like to be on record as requesting that this expansion request be denied. (AF-1)

Comment: I am adamantly opposed to any development or expansion of nuclear facilities Anywhere--but in Mississippi, Louisiana, Alabama, Texas, and Florida especially. (AG-1)

Comment: I am a Louisiana native, and oppose the proposed siting of the next Grand Gulf nuclear power plant in Port Gibson, Mississippi. (AI-1)

Comment: Louisiana is equally committed to Grand Gulf determinations through Entergy's System Agreement scheme. Entergy has spread its environmental costs into La. Therefore, Louisianans have a public duty to chose [choose] the most environmental begin [benign] energy products, but the wrong comparisons by this Commission will forever condemn these poor captive ratepayers to an eternal excessive yoke. (AJ-3)

Comment: The Bush Administration just does not understand this simple message. However, the Nuclear Regulatory Commission staff has a golden opportunity to help the current administration understand by recommending against issuance of an Early Site Permit for the Grand Gulf Site based upon the fact that the Draft EIS was prepared using inadequate information provided in large part by SERI. If and when the federal government and the utility industry act in a proactive and meaningful way to deal with the problems of long-term storage of nuclear wastes and potential terrorist incidents at nuclear plants and when a full analysis of all the potential impacts of new reactors at Grand Gulf is completed and the utility industry demonstrates it is willing to pay the full, unsubsidized cost for new reactors in accordance with free market principles, then issuance of an Early Site Permit should be reconsidered. (AK-5)

Comment: NRC must address and resolve the 300% demand for reactive power for Grand Gulf before considering any additional environmental requirements. 1) Identify problem sources 2) state-proposed remedy 3) Public acceptance of the proposed solution for this explosive issue. (AL-1)

Comment: Public Citizen views the draft EIS for the Grand Gulf ESP as deficient, and we disagree with the NRC staff's recommendation that the ESP should be granted. (AM-1, BA-1)

Comment: A decade ago, our governing authorities considered the gaming industry as the means to economic revival and renewal in this county. They suggested that a casino might be our goose that lays the golden egg. I silently voted "no" to the gaming industry because I considered gaming an "undesirable" industry. Today, I say no to nuclear industry because everything that glitters is not gold. (AQ-3)

Comment: NIRS requests that the SERI application be rejected. (AR-9)

Comment: This environmental impact statement (EIS), that has been prepared in response to an application submitted to the United States Nuclear Regulatory Commission (NRC) by System Energy Resources, Inc. (SERI) for an early site permit (ESP), is with {Emphasis Added} "Appalling," "Shocking" and very "Disturbing." (AV-1)

Comment: I am writing to oppose Entergy's application for an Early Site Permit at the Grand Gulf Nuclear Plant in Claiborne County, Mississippi. The information contained in the Draft Environmental Impact Statement is incomplete and insufficient so as to form a basis for acceptance of the application further. (AY-1)

Comment: So obviously the state of Mississippi is not in need of that extra power, and there's some reason that this spot is selected, because those other places that will be selling the power – they would be selling the power to probably don't want a nuclear – a second nuclear plant in their backyard. So it's clear that here we are desperate for jobs and it seems a high risk to take for the jobs that it would generate. (N-4)

Comment: Now the only time you'll see me get upset is when I see something happening in Claiborne County that looks like Grand Gulf Nuclear Power Number 1. I hope you all understand that. (O-1)

Comment: I am writing to express my strong opposition to the proposed nuclear power plant at Grand Gulf. (W-1)

Comment: I strongly oppose the building of a second reactor at the Grand Gulf Nuclear Plant in Claiborne County, Mississippi. (X-1)

Comment: As a Mississippian, I oppose the construction of additional nuclear reactors in Mississippi. (X-6)

Comment: I was distressed to hear about possible expansion of the nuclear power plant at Grand Gulf MS. This is a mistake. (Y-1)

Comment: I am very much against building more nuclear power plants until we figure out what to do with the waste!!!!!! (Z-1)

Comment: I am writing to OPPOSE Entergy's application for an Early Site Permit (ESP) at the Grand Gulf nuclear plant in Claiborne County, Mississippi. (BB-1, BC-1, BE-1, BF-1 BG-1, BJ-1, BK-1, BL-1, BM-1, MM-1)

Comment: In conclusion, too many questions remain to conclude that more nuclear power at Grand Gulf offers a benefit to Port Gibson, the state of Mississippi, or this country. (BB-7, BC-4, BD-8, BG-9, BJ-9, BL-8, MM-8)

Comment: Wife Virginia and I am writing to OPPOSE Entergy's application for an Early Site Permit (ESP) at the Grand Gulf nuclear plant in Claiborne County, Mississippi. (BD-1)

Comment: I hope you will take my ideas into consideration and decide not to build the Grand Gulf Nuclear plant. (BF-6)

Comment: Nuclear energy is already history: just look at the economics and the waste problems, and of course, the weapons spinoff: totally medieval in the present world. Solar/wind/hydrogen is already taking over. Get on board! (BG-8)

Comment: I oppose Entergy's application for an Early Site Permit (ESP) at the Grand Gulf nuclear plant in Claiborne County, Mississippi. (BH-1, BI-1)

Comment: In conclusion, it appears to me that too many questions remain to conclude that more nuclear power at Grand Gulf offers a benefit to Port Gibson, the state of Mississippi, or this country. (BH-8)

Comment: Too many questions remain to conclude that more nuclear power at Grand Gulf offers a benefit to Port Gibson, the state of Mississippi, or this country. (BK-4)

Comment: I marched against Hanford in Washington state in the 70's because I had read and investigated what they were doing there and knew that the land around this facility would be worthless for generations to come. While they were denying releasing gases in the area we found out in the 90's that they were doing that and now the land around Hanford is worthless. I just don't trust that when humans are in control that accidents won't happen. Nuclear accidents are a horror that I don't ever want to see in America. (BJ-3)

Response: *The preceding comments provide no new information for additional analysis. These comments did not result in a change to the environmental impact statement.*

Subject: Postulated Accidents

Comment: The DEIS should have covered the results of catastrophic and less severe accidents both at the plant and during transport. Instead, staff discussed the probability of accidents, found it low, and went no further. Better policy would be to look at accident scenarios and decide if the results are worth the risk, particularly when there are alternatives to nuclear facilities. The accident/risk scenarios are also issues at the reactor itself. I don't know of any other source of electricity so dangerous that it requires evacuation routes and special training of emergency and medical personnel. Increasing the number of reactors increases the risk of an accident or meltdown at the site. (AN-3)

Comment: The DEIS also does not address the following issues: a description of what kinds of accidents are potentially possible; the computer models used to ascertain potential release scenarios; the environmental health effects of an aftermath; the detailed capacity of the local, state and federal communities to react to such accidents (e.g., Local Emergency Planning Councils, fire departments, federal agencies) in explicit terms; and what track record the facility currently has as to accident prevention (e.g., results of chemical safety audits, emergency exercises, etc.). (AZ-13)

Response: *Design basis accidents are events that are considered credible and sufficiently likely that the reactor is designed to minimize impacts of the accident through defense in depth. Descriptions of the design basis accidents that are considered are found in U.S. Nuclear Regulatory Commission standard review plans NUREG-0800 (NRC 1987) and RS-002 (NRC 2004a). The names of the accidents are reasonably descriptive of the initiating event. Assumptions related to the release pathways and analytical procedures are found in the standard review plans and regulatory guides. Design basis and severe accidents are discussed in detail in Chapter 5 of the environmental impact statement. Because severe events are so unlikely, they can only be discussed meaningfully in terms of risk; i.e., the product of probability times consequences. NUREG-1150 describes the methods used to identify and determine the probability of severe accidents of interest. The MACCS2 code is used to determine the consequences of severe accidents. Several types of risks associated with severe accidents are evaluated in Tables 5-13 and 5-14 in Chapter 5 of the environmental impact statement. The addition of new reactors would increase the risks associated with an accident at the Grand Gulf site but not by much. For example, the data in Table 5-15 of the environmental impact statement indicate that the population dose risk within a 50-mi radius from a severe accident would increase by about 0.0002 Sv/yr if two AP1000 reactors were operated at the Grand Gulf site. The severe accident population dose risk estimated for the existing reactor is about 0.5002 Sv/yr. Adding the population dose risk for two postulated new reactors to the risk for the current reactor gives a total risk of about 0.5002 Sv/yr, which considering uncertainty is the same as the risk for the existing unit. The safety performance of the operator of the existing unit is not relevant to the issue under consideration; i.e., whether the site is acceptable for additional nuclear plants. Issues related to emergency planning are addressed in the safety evaluation report (NRC 2005). These comments did not result in a change to the environmental impact statement.*

Comment: So far, none of us have figured out how to live with the Mississippi River contaminated with radiation. Also, do you remember the movie, “The China Syndrome?” That almost happened at Three Mile Island (no, I’m not too young to remember that, as most pro-nuclear folks are hoping) and we can’t guarantee it won’t happen again. None of these plants can be made foolproof because of HUMAN ERROR. (AF-4)

Response: *The U.S. Nuclear Regulatory Commission staff assumes that this comment relates to accident-related releases. It is extremely unlikely that contaminated liquids from a design basis or severe accident would reach the Mississippi River. In the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NRC 1996) the staff evaluated risks* *of a severe accident with basemat melt-through for current generation power plants and concluded that the risks associated with releases to groundwater are smaller than those for the air pathway, which were determined to be small. The reasoning behind this conclusion is set forth in Section 5.10.2.3 of the environmental impact statement. The groundwater pathway risks associated with advanced reactors would be smaller than those for current generation reactors. This comment did not result in a change to the environmental impact statement.*

Comment: Also, the extensive industrial corridor between Baton Rouge and New Orleans depends on river water for processing. These industries would have to be shut down. Contamination of vital wetlands that provide nurseries for larval and other developmental stages of fish, for shrimp, oysters, etc., could devastate the seafood industry. Certainly the tourist industries in Florida, Mississippi, Louisiana, and Texas would be affected. This involves potentially billions/trillions of dollars and innumerable lives lost or changed because of an accident at this plant. These effects should be considered in any DEIS. Effects north of the facility should also be considered. (AN-10)

Response: *Although Louisiana parish economic development profiles list numerous manufacturers along the Mississippi River between Baton Rouge and New Orleans, most appear to be involved in such activities as industrial chemicals, metals, and shipping. Given the dilute level of radionuclides that are postulated downstream even in the case of a severe accident (Section 5.10.2.2), there appears to be no reason why industrial corridor manufacturers would have to be shut down. It is extremely unlikely that contaminated liquids from a design basis or severe accident would reach the Mississippi River. In the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NRC 1996) the staff evaluated risks of a severe accident with basemat melt-through for current generation power plants and concluded that the risks associated with releases to groundwater are smaller than those for the air pathway, which were determined to be small. The reasoning behind this conclusion is set forth in Section 5.10.2.3 of the environmental impact statement. The groundwater pathway risks associated with advanced reactors would be smaller than those for current generation reactors. This comment did not result in a change to the environmental impact statement.*

Comment: An accident or act of sabotage at this facility and its stored nuclear waste could contaminate the Mississippi River and the Gulf of Mexico. This would be disastrous to the communities downstream that depend on the river for drinking water. (AN-9)

Comment: With Grand Gulf so near the Mississippi River, a disaster could spell doom for coastal residents, tourism, and livelihoods. (X-5)

Response: *Health effects of severe accident scenarios are addressed in Section 5.10 and demonstrate that the expected impacts are small. The Grand Gulf early site permit safety* *evaluation report (NRC 2005) also addresses safety issues. Impacts on tourism and coastal communities due to potential actions of either regulatory authorities closing down facilities or consumer avoidance of products or locations due to concerns about contamination have not been included in the analysis. Such impacts are highly speculative because the potential contaminating event is considered a very remote possibility and both the mechanisms of contamination and the mechanisms of regulatory and consumer reaction are only partially understood. These comments did not result in a change to the environmental impact statement.*

Comment: The DEIS does not address the vicinity in radius miles that would be affected by a worst case accident scenario and a credible case accident scenario, either in the sections on Affected Environment or on Operation Impacts. It selects what appears to be arbitrary 10 km and 80 km boundaries for its discussion related to persons that would be affected by the siting of one or more additional nuclear power facilities. (AZ-12)

Response: *The 10-km (6-mi) and 80-km (50-mi) radii used to evaluate impacts of routine operations and accidents are specified in U.S. Nuclear Regulatory Commission guidance. The distances are based on evaluation of impacts of many reactors at many sites. Design basis accidents are events that are considered credible and sufficiently likely that the reactor is designed to minimize impacts of the accident through defense in depth. Severe accidents are extremely unlikely, worst-case events. The impacts of normal operations, design basis, and severe accidents are described in detail in Chapter 5 of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: From the radiological perspective, scenario(s) should be added to Section 5.10, Environmental Impacts of Postulated Accidents, Table 5.11, Design Basis Accident Doses for an Advanced Boiling Water Reactor and Table 5.12, Design Basis Accident for a Surrogate AP1000 Reactor, that addresses the impact of an attack on a spent fuel storage cask using artillery shells at Grand Gulf and the resulting implications of a dose to plant personnel and the public. The total effective dose equivalent at the exclusion area boundary, and in the low population zone, should be calculated. (AZ-3)

Response: *The U.S. Nuclear Regulatory Commission is devoting substantial time and attention to terrorism-related matters, including coordination with the U.S. Department of Homeland Security. As part of its mission to protect public health and safety and common defense and security pursuant to the Atomic Energy Act, the U.S. Nuclear Regulatory Commission staff is conducting vulnerability assessments for the domestic use of radioactive material. In the time since the horrific events of September 2001, the U.S. Nuclear Regulatory Commission has identified the need for license holders to implement compensatory measures and has issued several orders to license holders imposing enhanced security requirements. Finally, the U.S. Nuclear Regulatory Commission has taken actions to ensure that applicants* *and license holders maintain vigilance and a high degree of security awareness. Consequently, the U.S. Nuclear Regulatory Commission will continue to consider measures to prevent and mitigate the consequences of acts of terrorism in fulfilling its safety mission. Major U.S. Nuclear Regulatory Commission actions include the following:*

- *Ordering plant owners to sharply increase physical security programs to defend against a more challenging adversarial threat*

- *Requiring more restrictive site access controls for all personnel*

- *Enhancing communication and liaison with the Intelligence Community*

- *Improving communication among military surveillance, U.S. Nuclear Regulatory Commission, and its licensees to prepare power plant operators and to effect safe shutdown should it be necessary*
- *Ordering plant owners to improve their capability to respond to events involving explosions or fires*

- *Enhancing readiness of security organizations by strengthening training and qualifications programs for plant security forces*

- *Requiring vehicle checks at greater stand-off distances*

- *Enhancing force-on-force exercises to provide a more realistic test of plant capabilities to defend against an adversary force*

- *Improving liaison with Federal, State, and local agencies responsible for protection of the national critical infrastructure through integrated response training*

- *Working with national experts to predict the realistic consequences of terrorist attacks on nuclear facilities, including one from larger commercial aircraft.*

For the facilities analyzed, the results confirm that the likelihood of both damaging the reactor core and releasing radioactive material that could affect public health and safety is low. The subjects of this comment has been determined to be outside the scope of the environmental impact statement. This comment did not result in a change to the environmental impact statement.

Comment: Accident Scenarios: In its analysis of the potential consequences of “design basis” accidents, SERI used the characteristics of two reactor designs—the Advanced Boiling Water

Reactor (ABWR) and the Advanced Pressurized Water Reactor (AP1000)—assuming the impacts of such accidents would bound those of other possible reactor designs, a premise accepted by the NRC in its evaluation (EIS, § 5.10.1). For its analysis of "severe" accidents, SERI evaluates the consequences for the current generation reactors—not of the kind that it would build at the GGNS (EIS, pg. 5-63). How can the NRC reasonably judge accident consequences when several of the potential reactor designs proffered by SERI have never been deployed? (AM-5)

Response: *The reactors postulated by System Energy Resources, Inc. and the U.S. Nuclear Regulatory Commission staff in their design basis and severe accident analyses are advanced reactors that have been studied extensively. The designs of the other advanced reactors postulated in the System Energy Resources, Inc. application (SERI 2005), while not as thoroughly reviewed, are sufficiently well-developed to be able to identify new safety features that would reduce both the likelihood and severity of accidents. As a result, there is sufficient information that the staff believes the potential impacts of accidents for the postulated light water reactors would likely bound the impacts for the other reactors. However, should a construction permit or combined license application be submitted referencing one of the other reactors, the staff would require that application include accident analyses for the specific reactor mentioned in the application. This comment did not result in a change to the environmental impact statement.*

Subject: Safeguards and Security

Comment: Nuclear Energy is Too Dangerous: Nuclear energy has never been safe, but post 9-11 nuclear power plants and radioactive waste storage facilities have become terrorist targets as well. (AC-5)

Comment: Then, there is the problem of potential acts of terrorism at nuclear facilities. Neither the government nor the private utility industry has taken sufficient action to insure that a large scale terrorist attack against a nuclear plant can be thwarted, or that if such an attack occurred, it could be dealt with in a manner that would prevent release of nuclear material outside the boundaries of the plant. This omission constitutes a grave failure to provide for the common defense of our citizenry. (AK-3)

Comment: Nuclear power plants have known vulnerabilities to terrorist attack and sabotage. According to the 9/11 Commission Report, the infamous terrorist organization al Qaeda specifically discussed targeting U.S. nuclear plants. Fuel storage pools, dry storage facilities, and reactor control rooms are not designed to withstand the type [of] attack that occurred on September 11, 2001. The U.S. Government Accountability Office (GAO) concluded in recent testimony before the U.S. Senate that cargo and general aviation airfields are more vulnerable to security breaches than commercial airports. Ignoring the threat because it is "highly speculative” does not make the threat go away, and indicates one shortfall of using an exclusively risk-based approach—especially considering the GGNS’s location on the Mississippi River, which could make it an attractive strategic target. The draft EIS describes the Mississippi River as a “critical inland shipping route from the Gulf Coast to the interior of the South and Midwest” (pg. 2-4). One possible security measure to protect the reactor from assault by aircraft is to place a reactor below ground level. Therefore, an analysis in the draft EIS of the suitability of the site to place the reactor containment below-grade level should be done, which would require an in-depth analysis of geological and hydrological conditions at the site. (AM-20)

Comment: The 9/11 Commission has stated that attacks on nuclear power plants were discussed by Al Quaida. Therefore, a major flaw in the DEIS was the lack of consideration of a terrorist attack, both on the reactor itself and the waste storage area. I realize that the NRC Commissioners have ruled that terrorist attacks cannot be considered in a DEIS, but feel that this is the extreme of irresponsibility on the Commissioners’ part. Also, the Commissioners only considered an aerial attach [attack] and nothing by land in their ruling. Yet “The Grand Gulf site”… is accessible by both river and road (page 2-1) and the ESP site is less than two miles from the Mississippi River (Figure 2-2, page 2-21). A June 20, 2005 article in Time magazine raised frightening and believable issues concerning the ease with which a terrestrial attack by terrorists could be carried out- resulting in what the NRC Commissioners would term a “worst case” scenario. (AN-4)

Comment: Security is essentially left out completely. (I-6)

Comment: I’d like to point out that nuclear power stations in general are the most secure commercial facilities in the United States. Since September of 2001, the Nuclear Regulatory Commission has issued stringent new security regulations, and the nuclear industry has spent over a billion dollars, that's with a B, on compliance with these new regulations. (R-1)

Comment: These nuclear power plants are no “cleaner” now, than they were decades ago. They still emit radiation, and the proposed waste disposal ideas leave highly radioactive fuel rods buried either underground or in giant pools, both of which are usually unguarded. These plants are easy targets for terrorists or thieves who can walk in through an unlocked gate, take the nuclear waste or fuel rods they need, and leave, without being either stopped or questioned by guards. (AI-3)

Comment: This nuclear power plant should not be permitted, sited, or licensed, unless and until the NRC can effectively address the security concerns posed by these plants, the problems with nuclear power’s radioactive waste, and the agency’s dismissive attitude towards those people whose lives will be the most adversely affected by this plant, and who have little political clout in keeping one of these plants out of their communities. (AI-4)

Comment: Third, and most disturbing is the real threat of terrorism. From an environmental standpoint, the location is extremely difficult to protect from terrorist threats. There is a tremendous amount of unregulated traffic down the Mississippi River which is not able to be monitored in any way. An air attack would also be difficult to detect or intercept in a timely fashion. (Not to mention that I have even heard a first hand account of someone driving into the current plant to ask for information on touring the plant, who was not even stopped at the gate or asked for identification!) (W-4)

Comment: Nuclear power plants have known vulnerabilities to terrorist attack and sabotage. According to the 9/11 Commission Report, al Qaeda specifically discussed targeting U.S. nuclear plants. Fuel storage pools, dry storage facilities, and reactor control rooms are not designed to withstand the type (of) attack that occurred on September 11, 2001. Ignoring the threat because it is “highly speculative” does not make the threat go away, and indicates one shortfall of using an exclusively risk-based approach - especially considering Grand Gulf's location on the Mississippi River, which could make it an attractive strategic target. An analysis in the draft EIS of the suitability of the site to place the reactor containment below-grade level should be done, which would require an in-depth analysis of geological and hydrological conditions at the site. (BB-6, BC-3, BD-7, BG-7, BH-7, BI-5, BJ-8, BL-7, MM-7)

Comment: I also am seriously concerned about additional security risks. (BM-3)

Response: *The U.S. Nuclear Regulatory Commission is devoting substantial time and attention to terrorism-related matters, including coordination with the U.S. Department of Homeland Security. As part of its mission to protect public health and safety and common defense and security pursuant to the Atomic Energy Act, the U.S. Nuclear Regulatory Commission staff is conducting vulnerability assessments for the domestic use of radioactive material. In the time since the horrific events of September 2001, the U.S. Nuclear Regulatory Commission has identified the need for license holders to implement compensatory measures and has issued several orders to license holders imposing enhanced security requirements. The U.S. Nuclear Regulatory Commission has taken actions to ensure that applicants and license holders maintain vigilance and a high degree of security awareness. Consequently, the U.S. Nuclear Regulatory Commission will continue to consider measures to prevent and mitigate the consequences of acts of terrorism in fulfilling its safety mission. Major U.S. Nuclear Regulatory Commission actions include the following:*

- *Ordering plant owners to sharply increase physical security programs to defend against a more challenging adversarial threat*

- *Requiring more restrictive site access controls for all personnel*

- *Enhancing communication and liaison with the Intelligence Community*

- *Improving communication among military surveillance, U.S. Nuclear Regulatory Commission, and its licensees to prepare power plants and to effect safe shutdown should it be necessary*

- *Ordering plant owners to improve their capability to respond to events involving explosions or fires*

- *Enhancing readiness of security organizations by strengthening training and qualifications programs for plant security forces*

- *Requiring vehicle checks at greater stand-off distances*

- *Enhancing force-on-force exercises to provide a more realistic test of plant capabilities to defend against an adversary force Improving liaison with Federal, State, and local agencies responsible for protection of the national critical infrastructure through integrated response training*

- *Working with national experts to predict the realistic consequences of terrorist attacks on nuclear facilities, including one from larger commercial aircraft.*

For the review of the Grand Gulf early site permit facility, the U.S. Nuclear Regulatory Commission staff addressed in the safety evaluation report (NRC 2005) whether the site characteristics are such that adequate security plans and measures can and will be developed (10 CFR 100.21). For the facilities analyzed, the results confirm that the likelihood of both damaging the reactor core and releasing radioactive material that could affect public health and safety is low.

With respect to the impacts of terrorism, the Commission has determined that malevolent acts, including terrorism, are remote and speculative and thus beyond the scope of a National Environmental Policy Act of 1969 review (Private Fuel Storage, L.L.C. 2002). The subjects of these comments have been determined to be out of the scope of the environmental impact statement. These comments did not result in a change to this environmental impact statement.

Subject: Safety Review for ESP

Comment: The effects on the populace of Claiborne County are not the only effects that should be considered. The Grand Gulf site is located near the Mississippi River (the ESP site is less than two miles (Figure 2-2, page 2-21) from the river) in an area prone to damage from hurricanes, tornadoes and flooding. It is also an area of the River that would allow easy access for terrorists, particularly from a boat or barge. (AN-8)

Response: *Nuclear power plants are extremely robust structures designed to survive hurricane and tornado strikes. Safety procedures at a nuclear facility also include the possibility of hurricanes, tornadoes, and floods. The Unusual Event declaration (the lowest of four safety-related declarations) is routine in the event of a hurricane, and the plant's procedures typically require that the plant be shut down should hurricane winds reach Category III, which is 111 miles per hour or higher. Each plant has emergency diesel generators available if needed, additional diesel generators (normally used in routine operations), and emergency battery power available should the need arise. Safety-related issues are covered in the Grand Gulf early site permit safety evaluation report (NRC 2005). This comment did not result in a change to the environmental impact statement.*

Comment: Aside from being near the Mississippi River, overflows from which could become problematic, the Grand Gulf plant and proposed GGII are on the New Madrid earthquake fault. (AO-3)

Response: *The geology of the Grand Gulf site is described only briefly in the environmental impact statement. Section 2.5 of the safety evaluation report (NRC 2005) contains a description of the geology of the site. This discussion includes a detailed description of the seismic characteristics of the region including the New Madrid fault. This comment provides no new information. This comment did not result in a change to the environmental impact statement.*

Subject: Socieconomics

Comment: To put all of this in some kind of perspective: The above just-mentioned Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource {LARGE}!

What will it profit the Citizens of Claiborne County, 1) approve a site within the existing Grand Gulf Nuclear Station boundaries as suitable for the construction and operation of a new nuclear power generating facility, and 2) issue an ESP for the proposed site identified as the Grand Gulf ESP site collocated with Gulf Nuclear Station and lose the benefits.

According to this Environmental Impact Statement, the first Grand Gulf Nuclear Power Plant, did nothing, absolutely nothing, to change and affect the minority and low-income population, poverty, housing, medical, and the unemployment rate, within the County (Claiborne County) where the first Grand Gulf Nuclear Power Plait [plant] is located. (AV-2)

Comment: Further, the information that is contained in the document suggests that the peculiar economic situation faced by the host community makes it unlikely that an emergency at the plant can be addressed in the necessary manner. (BB-2, BG-2, BJ-2, MM-2)

Comment: And the information that is contained in the document suggests that the peculiar economic situation faced by the host community makes it unlikely that an emergency at the plant can be addressed in the necessary manner. (BD-2)

Comment: I have heard that the information contained in the document suggests that the peculiar economic situation faced by the host community makes it unlikely that an emergency at the plant can be addressed in the necessary manner. (BH-2)

Response: *The comments provide no new information. These comments did not result in a change to the environmental impact statement.*

Comment: And I find it more peculiar that the Nuclear Regulatory Commission, in licensing this plant in 1985, never revisited the fact that the Mississippi State legislature went about stripping this county of money that needs to go into emergency planning and security. (H-3)

Response: *Control of or influence on local, regional, or state taxing and revenue distribution is outside the authority of the U.S. Nuclear Regulatory Commission. The distribution of revenue from the existing Grand Gulf facility is outside the scope of this environmental impact statement. However, current and possible future revenue distributions from a new nuclear facility at the Grand Gulf early site permit site were evaluated and their effects addressed in this environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Page 2-63 of the DEIS uses a 16 km (10 mile) reference for discussion on population numbers. It is unknown where this 16 km figure arises from. The population figure is apparently limited to residents, and does not include workers affected, which may be significant. The only reference to workers is a table discussing residential locations of workers. (AZ-16)

Response: *A discussion of transient population has been added to Section 2.8.1. This comment resulted in a change to Section 2.8.1.*

Comment: I would like to see an educational program set up in the school system of Claiborne County to encourage children to study math and science. I would much rather see the majority of the workforce for another unit to come from Claiborne County. (AS-8)

Response: *A workforce educated in mathematics and science and specifically trained for nuclear industry jobs likely would have a better chance of securing employment at a new nuclear facility in Claiborne County than would a workforce without such skills. This observation also applies to the existing Grand Gulf Nuclear Station. Hiring decisions for jobs at any future nuclear plant at the Grand Gulf early site permit site would be made based on the* *qualifications of the candidates that present themselves at the time the plant is built and put into operation. The development of local general education or specific training programs is the responsibility of state and local government and could be assisted by the operating company should they choose to do so. The environmental impact statement only evaluates whether an adequate workforce can be made available at the Grand Gulf early site permit site. Additional information has been added to the environmental impact statement to evaluate System Energy Resources Inc.'s assumption that 50 percent of the workforce could come from the region. This comment resulted in a change to Section 4.5.2.*

Comment: Mississippi tax code is unique in that nuclear plants are exempt from all county, municipal, and district taxes. Instead, SERI pays taxes to the state of Mississippi in a sum based on the assessed value of the plant, and the State redistributes the brunt of the funds—about 70 percent—to other counties. Still, Claiborne County receives at least $7.8 million annually from SERI, roughly 83 percent of the county's tax revenues (EIS, pg. 2-68). This position of dependency puts Claiborne County in a tenuous situation that may deteriorate if SERI moves forward with this project. Indeed, the existing reactor, in more than twenty years of operation, has not lifted the community out of poverty. More than 32 percent of the population in Claiborne County exists below the poverty level, and the county has been classified as a "persistent poverty" county (EIS, pg. 2-64) with an unemployment rate of 12.4 percent (EIS, pg. 2-67). Considering SERI's desire to operate its new reactor as an unregulated merchant facility, its value as a source of tax revenue in the county is in question. The development of an unregulated, merchant facility would not bode well for Claiborne County or Mississippi, since such a facility may be exempt from a large portion of the taxes required of a regulated facility (EIS, pg. 4-30). The NRC's presumption that a deregulated facility may actually increase SERI's property tax payments to Claiborne County (EIS, pg. 5-34) is unjustified and contrary to experience. Unregulated electric generation facilities are less reliable sources of tax revenue than regulated facilities. In Illinois, for example, nuclear operator Exelon exploited changes in the tax structure under a deregulated utility environment to dramatically reduce its local property tax payments. The NRC's draft EIS for an ESP at the Exelon ESP site at the Clinton Power Station (CPS) in Illinois reports that the annual property taxes paid by Exelon on its CPS have declined dramatically since 1996, when it paid roughly $17.9 million to DeWitt County and other taxing districts, to $9.1 million in 2002 (Exelon EIS, Table 2-13). Over this period, Exelon's property tax payments have declined from 80 percent of the county's total property tax revenue in 1996 to 53 percent in 2002 (Exelon EIS, pg. 2-61). The cause for the precipitous decline is attributed to "a transition period of declining property tax collections due to deregulation" (Exelon EIS, pg. 2-53). Whereas before deregulation property taxes were based on the "depreciated assessed value of the CPS" (Exelon EIS, pg. 2-53), the institution of deregulation has allowed Exelon to pay taxes based on the market value of power produced from the plant, and Exelon's assessed valuation of the plant has plummeted from $559 million in 1996 to a mere $165 million in 2003, only 40 percent of DeWitt County's assessment for that same year (Exelon EIS, Table 2-14). Meanwhile, the draft EIS for

Exelon's ESP reports that the consensus feeling among DeWitt County officials is that the economy of the region has "reached bottom" (pg. 2-47), and Clinton School District 15 has been forced to cut its budget by $3 million and spending reserves over the past several years (EIS, pg. 2-60). This scenario of deregulation should be considered in the final EIS for the Grand Gulf ESP. (AM-18)

Response: *Although the existing Grand Gulf Nuclear Station has not lifted Claiborne County out of poverty, it does provide about 83 percent of tax revenues received by the county and allows a lower property tax rate than prevails in nearby Jefferson County, which is similar economically in other respects but has no nuclear power plant. In addition, some of the county population does work at the facility. The Illinois experience in Dewitt County is not directly germane. There, under deregulation, the management of the existing nuclear power plant was able to negotiate a reduction in assessed property value because the basis for assessed value changed. In the case of the Grand Gulf site, no change in taxation of the existing nuclear power plant is contemplated, so it will continue to generate revenue under existing provisions of the Mississippi tax law. However, a new nuclear power plant, if it were treated as an ordinary industrial asset because of its merchant plant status, could yield considerable new tax revenue to local government. This likely would be true even if the assessed property value were negotiated downward or System Energy Resources, Inc. made payments to the local government in lieu of taxes. Even if the plant were treated for tax purposes as operated by a public utility, the increase in Claiborne County's share of annual revenues under current law would be a minimum of $7.8 million, an 87 percent increase in total county revenue. This comment did not result in a change to the environmental impact statement.*

Comment: Have members of the school board for the Port Gibson district been contacted about the potential influx of 460 children—a 38 percent increase over the present student population—that could result from construction activities at the GGNS (EIS, § 4.5.4.5)? Such an increase could be a substantial burden, yet it does not appear that school administrators were contacted for this draft EIS (see Appendix B, "Organizations Contacted"). (AM-22)

Response: *Although the Superintendent of Schools was on the staff's list of requested attendees and was invited, neither the members of the Port Gibson school board nor the school administration staff attended the meeting with public officials held in Port Gibson on April 13, 2004. To the staff's knowledge, no one representing the school district attended either the public scoping meeting or the public meeting on the draft environmental impact statement, nor did anyone from the school district comment on either the proposed scope of the environmental impact statement or the draft environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Based on the information provided in this Environmental Impact Statement, SERI, Entergy, the second Grand Gulf Nuclear Power Plant should be exempt from county, municipal, and district ad valorem taxes, as well as any in lieu payment of county, municipal, and district ad valorem taxes, totally EXEMPT.

SERI, Entergy, the second Grand Gulf Nuclear Power Plant would pay a sum based upon INCOME to fund local 501(c)(3) organization(s) considering Education, Economic Development, Housing, and Health on a competitive basic, to help develop Claiborne County and its residents (who are disproportionately minority and low-income), no less than the value of the nuclear generating plant, thus further guaranteeing a TAX WRITE-OFF, for SERI, Entergy. (AV-5)

Response: *In Sections 2.8.2.3, 4.5.3.2, and 5.5.3.2, the environmental impact statement identifies the possibility that a second Grand Gulf nuclear power plant might be exempt from county, municipal, and district level taxes if System Energy Resources, Inc. is treated under Mississippi State tax code as a "public utility." If the plant is operated as a merchant plant, the rationale for treating System Energy Resources, Inc. as a public utility is much less obvious, and the nuclear power plant may be treated as an ordinary industrial facility that is subject to either property taxes or in lieu payments. The commenter proposes a private poverty assistance program that would be funded by System Energy Resources, Inc. Such arrangements could be helpful to the community but would not mitigate any environmental or socioeconomic impact of construction and operation of a nuclear power plant and would not be required for early site permit approval. This comment did not result in a change to the environmental impact statement.*

Comment: Based on the information provided in the environmental impact statement, SERI, Entergy, the second Grand Gulf nuclear power plant should be exempt from county, municipal and district level on taxes as well as any other in lieu payments of county, municipal and district level on taxes totally exempt. (D-4)

Response: *In Sections 2.8.2.3, 4.5.3.2, and 5.5.3.2, the environmental impact statement identifies the possibility that a second Grand Gulf nuclear power plant might be exempt from county, municipal, and district level taxes if System Energy Resources, Inc. is treated under Mississippi State tax law as a "public utility." If the plant is operated as a merchant plant, the rationale for treating System Energy Resources, Inc. as a public utility is much less obvious, and the nuclear power plant may be treated as an ordinary industrial facility that is subject to either property taxes or in lieu payments. However, either way, the increase in revenue to Claiborne County would be substantial under existing law. This comment did not result in a change to the environmental impact statement.*

Comment: To put all this in some kind of perspective, the above just mentioned environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resources. What would it profit Claiborne County to approve of this site out there, and then lose all of the benefits? (D-1)

Response: *None of the information presented in the comment demonstrates any environmental effect that would result in destabilizing important attributes of resources near the Grand Gulf early site permit. The likeliest situation is that Claiborne County would gain a significant measure of economic benefit and wouls not have to provide public services to a significantly larger resident population. This comment did not result in a change to the environmental impact statement.*

Comment: The DEIS states that the "staff assumed the plant would be taxed as an ordinary taxable business asset" and therefore taxable by Claiborne County. Under the current State tax code this is a baseless assumption. (AR-3)

Response: *Section 27-35-309 of the Mississippi Code specifically relates to a nuclear generating plant "located in the state, which is owned or operated by a public utility rendering electric service in the state and not exempt from ad valorem taxation under any other statute." It is questionable whether the owner or operator of a new nuclear power plant at the Grand Gulf early site permit site would be a "public utility rendering electric service in the State" under Mississippi law if it sold no electricity at retail in Mississippi. A "public utility" in Mississippi law includes persons, corporations, trustees, and receivers who own or operate equipment or facilities for the generation, manufacture, transmission or distribution of electricity to or for the public for compensation. Grand Gulf Nuclear Station was originally 90 percent owned by Middle South Utilities (a multi-state holding company that sold no electricity at retail in Mississippi) and 10 percent by the Southeast Mississippi Electric Power Association. It was operated by Mississippi Power and Light Company, a wholly owned subsidiary of Middle South Utilities. Mississippi Power and Light Company was a public utility rendering electric service in the state. The plant was taxable because Mississippi Power and Light operated the plant. Middle South was not considered a public utility in the state, and Southeast Mississippi Electric Power Association was not a public utility and was, in any case, tax-exempt under Section 27-31-15 (Mississippi Attorney General 1990). Based on this observation, an entity that owned and operated a new plant for wholesale markets outside of Mississippi might not fall under Section 27-35-309 and would be an ordinary industrial asset, so far as this special provision of state law is concerned. This comment did not result in a change to the environmental impact statement.*

Comment: Population: The DEIS does not address the population of workers in the selected 10 km or 80 km radius. In addition, it does not define: a quantitative or qualitative description of the chemical plant facilities in this proximity, or even a wider radius that may be more realistically affected; types of chemicals that are produced and released to the environment by these facilities; and specifics of the nuclear-related accident scenarios that may be potentially generate adverse radiological and non-radiological health effects, and have potential adverse productivity on these worker neighbors. A GIS map of all the regulated facilities within the project area of concern (80 km radius) should be incorporated in the FEIS. (AZ-15)

Response: *Sections 2.8.1 and 4.5.2 have had an expanded assessment of worker availability and large employers added. Non-radiological and radiological health impacts of normal operations are addressed in Sections 5.8 and 5.9. Although based on resident populations, these impacts are expected to be conservative because net daily commuting is out of the nearby counties and away from the Grand Gulf early site permit site. Effects of both design basis accidents and severe accident scenarios are addressed in Section 5.10. There is no valid basis for combining the potential emissions of nuclear and non-nuclear facilities in the manner requested. This comment resulted in a change to Sections 2.8.1 and 4.5.*

Comment: On page 2-75, the discussion should be expanded on the Police, Fire and Medical capabilities in more detail. It is clear that there are already serious deficiencies in response capacity. (AZ-17)

Response: *The comment does not discuss what other details would be required for a more meaningful analysis. The section describes local officials' concerns and compares these concerns with performance in emergency planning tests. Emergency preparedness is a safety issue that is addressed in the Grand Gulf early site permit safety evaluation report (NRC 2005). In accordance with 10 CFR 52.18, the Commission must determine, in consultation with the Federal Energy Management Agency, whether the information submitted by the applicant shows there is no significant impediment to the development of emergency response plans. This comment did not result in a change to the environmental impact statement.*

Comment: AAEA concurs with the NRC staff position that the Grand Gulf ESP site "would not result in disproportionate and adverse offsite environmental impacts to minority and low-income populations." We agree with the findings that impacts during the construction would be temporary and insignificant. The NRC concluded that there would be a MODERATE impact if tax revenues were not allocated to the local community to mitigate for additional construction traffic and new residents. The city, county and state governments should assure that any tax revenues generated by a new nuclear power plant should be equitably distributed. The tax considerations are included in EIS Section 2.8: Socioeconomics. (AW-4)

Comment: AAEA believes that the operation of a second nuclear unit at Grand Gulf would be positive for the local, state, regional, and national communities. The regional and national impacts would be reductions in smog-forming and greenhouse gases that would be beneficial to downwind states. AAEA concurs with the conclusions in the report that operation of a new facility would be beneficial to the local community and "the impacts to minority and low-income populations from operating new units at the Grand Gulf ESP site would be minor." The tax questions surrounding the operation of the facility will be determined at some future date by the county and state legislatures. This is also the conclusion of the NRC staff. (AW-5)

Comment: AAEA concurs with NRC staff in concluding that, "the cumulative environmental impacts related to environmental justice would be SMALL." Concurrently, "if tax revenues dramatically increase, the residents of Claiborne County (who are disproportionately minority and low-income) would enjoy LARGE beneficial tax revenue impacts." (AW-6)

Response: *These comments provide no new information for additional analysis. These comments did not result in a change to the environmental impact statement.*

Comment: SERI, Entergy, the second Grand Gulf nuclear power plant will pay a sum based upon income to fund local 501(c)(3) organizations considering education, economic development, housing, and health on a competitive basis to help develop Claiborne County and its residents who are disproportionately minority and low income. No less than the value of the nuclear generating plant does further guarantee a tax write off for SERI Entergy. (D-5)

Response: *The commenter proposes a private poverty assistance program that would be funded by System Energy Resources, Inc. Such arrangements could be helpful to the community but do not mitigate any environmental or socioeconomic impact of a nuclear power plant and would not be required for early site permit approval. This comment did not result in a change to the environmental impact statement.*

Comment: It is not clear that a new reactor at the GGNS would provide an economic benefit to the people of Claiborne County; in fact, new development at the GGNS may prove to be a drain on the county's resources. According to findings in the draft EIS, it is "not clear whether Claiborne County would receive property taxes, sales, and use taxes, or other taxes and public monies commensurate with the costs of its additional emergency management and public services obligations. The net financial burden may fall on local residents and taxpayers, most of whom are minority and low-income persons" (§ 5.7.3). If this situation is realized, the NRC staff judges that "the socioeconomic burden on local taxpayers (largely minority, and a majority of whom are low income) may be adverse, disproportionate, and MODERATE" (EIS, § 4.7.2). Construction of the first reactor at the GGNS resulted in very large cost overruns which were passed on to electric ratepayers who were subsequently represented in a successful lawsuit against Entergy over the extraordinarily expensive plant. Local officials have testified to the fact that an additional reactor could overburden their already insufficient resources (EIS, pg. 2-74). The Claiborne County sheriff, Frank Davis, said in an affidavit that "additional man power is needed to fully fill the required needs of our emergency evacuation plan and provide additional services at Grand Gulf Nuclear Power Plant since the 911 disaster," while the deputy sheriff attested that “the addition of another plant or two plants will further burden the limited resources and infrastructure of the Claiborne County’s Sheriff’s Department while exacerbating a disproportionate impact on the minority and low-income community of Claiborne County.” Furthermore, Claiborne County Hospital Administrator, Wanda Fleming, affirmed in an affidavit that “any additional nuclear power station unit or units to the current Grand Gulf nuclear generating station would further complicate effective medical response to a radiological emergency and would, most likely, multiply our inabilities to do so many times over.” This testimony calls into question whether the nuclear generation development at the GGNS proposed by SERI meets the NRC regulatory requirement at 10 CFR § 52.18 that ESP applications must demonstrate that “there is no significant impediment to the development of emergency plans” and “provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.” Assurance that a new nuclear unit at the GGNS would not compromise the ability of emergency responders to handle an accident at the GGNS is absent from SERI’s ESP application and the EIS. (AM-17)

Comment: It is not clear that a new reactor at Grand Gulf would provide an economic benefit to the people of Claiborne County. In fact, new development at Grand Gulf may prove to be a drain on the county’s resources. According to findings in the draft EIS, it is “not clear whether Claiborne County would receive property taxes, sales, and use taxes, or other taxes and public monies commensurate with the costs of its additional emergency management and public services obligations. The net financial burden may fall on local residents and taxpayers, most of whom are minority and low-income persons.” Local officials have testified to the fact that an additional reactor could overburden their already insufficient emergency preparedness resources. (BD-4, BG-4, BH-4, BJ-5, MM-4)

Comment: It is not clear that a new reactor at Grand Gulf would provide an economic benefit to the people of Claiborne County; in fact, new development at Grand Gulf may prove to be a drain on the county’s resources. According to findings in the draft EIS, it is “not clear whether Claiborne County would receive property taxes, sales, and use taxes, or other taxes and public monies commensurate with the costs of its additional emergency management and public services obligations. The net financial burden may fall on local residents and taxpayers, most of whom are minority and low-income persons.” Local officials have testified to the fact that an additional reactor could overburden their already insufficient emergency preparedness resources. (BL-4)

Comment: Economic development is no excuse for this either, since, according to findings in the draft EIS, it is “not clear whether Claiborne County would receive property taxes, sales, and use taxes, or other taxes and public monies commensurate with the costs of its additional emergency management and public services obligations. The net financial burden may fall on local residents and taxpayers, most of whom are minority and low-income persons." Local officials have testified to the fact that an additional reactor could overburden their already insufficient emergency preparedness resources. (BI-3)

Response: *The environmental impact statement discusses the distribution of tax revenues and their consequences in Sections 2.8.2.3, 4.5.3.2, and 5.5.3.2 as well as in Sections 4.7 and 5.7. The sections describe local officials' concerns and compare these concerns with performance in emergency planning tests. Emergency preparedness is a safety issue, which is addressed in the Grand Gulf early site permit safety evaluation report (NRC 2005). In accordance with 10 CFR 52.18, the Commission must determine in consultation with the Federal Emergency Management Agency, whether "there is no significant impediment to the development of emergency plans." Because an early site permit is an approval for a site only and does not constitute an approval to construct and operate a facility, an applicant for an early site permit may, but need not, propose major features of emergency plans or propose complete and integrated emergency plans (see 10 CFR 52.17(b)(2)). The Commission must only determine whether there is "reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency" if the early site permit applicant does in fact propose complete and integrated emergency plans under 10 CFR 52.17(b)(2)(ii). System Energy Resources Inc. has elected to propose major features of an emergency plan under 10 CFR 52.17(b)(2)(i), which the U.S. Nuclear Regulatory Commission has reviewed and found acceptable in the final safety evaluation report for the Grand Gulf early site permit site.*

Pursuant to 10 CFR 52.79(d), System Energy Resources, Inc. would be required to submit complete emergency plans in connection with a combined license application referencing the proposed Grand Gulf early site permit. The U.S. Nuclear Regulatory Commission defers to the Federal Emergency Management Agency on the adequacy of offsite emergency preparedness. The Federal Emergency Management Agency has evaluated emergency plans and training in past offsite exercises and has found the plans and their execution adequate. The siting of a second nuclear power plant at the Grand Gulf site does not double the offsite planning and evacuation burden and, depending on where Grand Gulf workers decide to live, may not significantly add to nearby populations or to responsibilities of local government. Additional information on the emergency planning and response analysis for the Grand Gulf early site permit application is contained in the site safety analysis report (SERI 2005). This comment did not result in a change to the environmental impact statement.

Comment: The possibility of luring a second unit at GGNS is palatable to our governing authorities and now presented as Claiborne County's best chance (and possible last chance) for economic renewal and revival. They're betting everything on Unit II. They expect the construction period to jump start our economy. They have high expectations that a higher percentage of local residents will land permanent jobs when Unit II opens that we presently have under Unit I. They hope that the Mississippi Legislature which took tax dollars from this country in the past will either be precluded by law from doing so; or will alternatively be merciful enough to allow this country to retain those benefits because it's the right thing to do. We desperately need new employers and an expanded tax base to prevent further demise and deterioration in our community, as is occurring in surrounding communities. For example, our neighbor, Jefferson County (whose governing board has also endorsed GG Unit II) had to resort to bringing not one, but two prisons (undesirable industries) to that community. Just as Jefferson county has doubled up on prisons, Claiborne County now appears poised to double-up and become the home of not one, but two nuclear power units. Grand Gulf Nuclear Station is a significant employer, offering by far, the best opportunities and benefits in this country. Entergy, Inc. has distinguished itself as a premier entity in the field of nuclear power as evidenced by its numerous safety and operation awards presented to GGNS. While the technology used in constructing and operating Unit II will be second to none in the world, nothing man-made is flawless or perfect. (AQ-2)

Response: *This comment provided no new information for additional analysis. This comment did not result in a change to the environmental impact statement.*

Comment: I would like to see a clearer statement of the impact on health and the economy of the area. (BM-2)

Response: *Effects of new nuclear power on the health and health-related economy of the region are discussed in Sections 4.5.4, 4.8, 4.9, 5.5.4, 5.8, and 5.9 of the environmental impact statement. The comment provides no new information. This comment did not result in a change to the environmental impact statement.*

Subject: Support for NRC's ESP Process

Comment: The early site process preserves the option to build new nuclear power plants, helping ensure that we will have a diverse, secure, sustainable, energy source to power our future. And we need reliable and affordable and clean energy supplies for Mississippi and for America in the decades to come. (T-2)

Comment: The early site process preserves the option to build new nuclear power plants, helping ensure that we will have a diverse, secure, sustainable, energy supply to power our future. We need reliable ... affordable ... clean sources of energy for Mississippi and America. (AX-2)

Comment: And it's good to see that the NRC is reviewing nuclear plants, reviewing them extensively and reviewing generically so that the process can move along much quicker than it has been in the past. (C-1)

Comment: This is a very important process, it's a very important topic, and it shows that the people are very interested in this early site permitting process. (K-1)

Comment: But I'm so happy that we have this meeting here so that people can hear opposing views and they can use their own intelligence and common sense to make up their minds. (Q-1)

Response: *These comments provided no new information for additional analysis. These comments did not result in a change to the environmental impact statement.*

Subject: Support for the Licensee or Licensee's Application

Comment: I mean, this is something that I know can be good and will be good, you know, even for the state of Mississippi. Let's not leave them out. But I'm more concerned about Claiborne County/Port Gibson. (A-1)

Comment: I support Entergy's decision to build a nuclear – a new facility at Grand Gulf. We think that this is something that can be good and positive for our community. (A-3)

Comment: The Jefferson County Board of Supervisors recognizes the important impact that is associated with locating a new, advanced technology nuclear power plant in this area. All elected leaders appreciate the economic impact and job creation opportunities that are created for our citizens. We recognize the exemplary safety track record of Grand Gulf, Entergy, and System Energy Resources. (AU-1)

Comment: As there are positive economic opportunities associated with the expansion of Grand Gulf, there are also potential negative externalities that all elected representative of the public must consider since our first obligation is to protect the health, safety, and welfare of our citizens. (AU-2)

Comment: AAEA supports the Early Site Permit (ESP) to build a new nuclear power plant at the Grand Gulf site. (AW-1)

Comment: AAEA supports the Nuclear Regulatory Commission (NRC) staff recommendation, based on the draft environmental impact statement (DEIS), that an ESP should be issued to System Energy Resources, Inc. (SERI) to build a new nuclear power plant within the existing Grand Gulf Nuclear Station (GGNS).

The fundamental reasons that AAEA supports nuclear power are:

- Nuclear power provides electricity safely and reliably,

- Nuclear power produces no smog forming emissions,
- Nuclear power produces no greenhouse gases,
- Spent fuel can be reprocessed for reuse,
- Yucca Mountain is acceptable as a repository for non-recyclable products,
- Nuclear power has an excellent quarter century safety record, and
- Nuclear power plants can use nuclear bomb warhead material as a fuel. (AW-2)

Comment: AAEA supports the ESP for the Grand Gulf location. We encourage the facility owner to accelerate its decision to apply for a construction and operating license and to construct a new plant at the earliest possible date. (AW-9)

Comment: I would like to applaud SERI and Entergy for pursuing an early site permit at the Grand Gulf Station, and for its efforts in preserving options to make prudent future choices to provide electricity for customers in Mississippi for decades to come. (AX-1)

Comment: The Jefferson County Board of Supervisors recognizes the important impact that is associated with locating a new advanced technology nuclear power plant in this area. All elected leaders appreciate the economic impact and job creation opportunities that are created for our citizens. (B-1)

Comment: We recognize the safe track record of Grand Gulf energy and System Energy Resources, as there are positive economic opportunities associated with this expansion of Grand Gulf. (B-2)

Comment: We support nuclear power, and we support this ESP for Grand Gulf. We support it because nuclear power is emission free, no carbon dioxide emissions, no NOX, no SOX emissions, and you can also use weapons grade material and blend it down and use it in nuclear power plants. So for many reasons, we support nuclear power. But let’s just be careful with that. (E-1)

Comment: And it’s my pleasure to join with the local Mississippi ANS sector to add our support for SERI’s application for a license to Grand Gulf for a potential new nuclear building. That recommendation is built upon our belief that the performance of the current nuclear fleet of 103 reactors had demonstrated that nuclear power can produce electricity safely, securely, reliably, and an affordable and emission free manner. (F-1)

Comment: I can whole heartedly say – and stand here and say, that we support the early site permit of Grand Gulf. (J-1)

Comment: We're committed to planning for our future. We cannot sit back and wait till there's a shortage of power to look at opportunities. It is an opportunity to create jobs, we are very committed to creating jobs. (L-1)

Comment: Get behind it, let's support it locally. (M-2)

Comment: If more base load power will be needed, and we know that eventually it will, if aging power plants with environmentally harmful emissions need to be retired, and we know that they will, then nuclear is the safest, most secure, and cleanest opportunity to provide for emissions free power. (R-2)

Comment: I support acceptance of the ESP, and that I think the community should take into consideration something which has been brought up, and it's a sore spot for a lot of folks because there's a lot of misconception. (S-1)

Comment: I would like to applaud SERI and Entergy for pursuing an early site permit at the Grand Gulf Station, and for its efforts in preserving options to make prudent future choices to provide electricity for customers in Mississippi for decades to come. (T-1)

Comment: I'd just like to join many local government leaders, residents here in Port Gibson and Claiborne County, and 83 percent of Americans who believe that nuclear energy is going to be an important part of our energy future. (T-3)

Comment: I am in support of the application for the early site permit. I believe that the vast majority of people in this county are supportive of it, very deeply. (U-1)

Comment: I also want to commend them for reaching out to the community, particularly over the last year, and involved [themselves] with helping Claiborne County and the City of Port Gibson assess their needs, not only for the existing nuclear facility, but for any other nuclear facility that may ever be located here. They've spent a lot of time and energy working not only with government officials, but including a lot of us as private citizens. (U-2)

Comment: The third and final thing is I own land very close to the nuclear power plant. Most of it's hunting land, and a part of it is in the federal wetlands programs. I've owned that land for, you know, probably 15 years, and I can say clearly that the nuclear power plant has had absolutely no adverse affect on my hunting ground. And I can see the nuclear tower when I'm hunting my deer, so I'm pretty close to it. (U-3)

Comment: Grand Gulf has been a wonderful corporate citizen in terms of grant monies that are provided to the town of Port Gibson, in terms of grant monies that are provided to the schools of Port Gibson, in terms of the tax base, in terms of personnel who work at Grand Gulf that have been involved with our community. On a personal level, living in our community, contributing to the society here in Port Gibson, and we are in support of the building of another nuclear facility at the Grand Gulf site. (V-1)

Response: *These comments provided no new information for additional analysis. These comments did not result in a change to the environmental impact statement.*

Subject: Surface Water Use and Quality

Comment: Surface Water: Section 4.4.2 of the DEIS discusses the addition of a new surface water intake to provide water to the proposed facility. As noted in the DEIS, discharges to surface water would require an NPDES permit. (AZ-19)

Response: *A National Pollution Discharge Elimination System permit issued by the Mississippi Department of Environmental Quality would be required prior to operation of the proposed facility. Additionally, during the construction phase, a National Pollution Discharge Elimination System storm water construction permit would be required to ensure that appropriate measures are implemented to limit impacts to the aquatic ecosystem during the construction phase. Further information on the National Pollution Discharge Elimination System permit for the proposed facility is discussed in Sections 4.3 and 4.10 of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: New Orleans depends on the Mississippi to supply its drinking water (scary, but true). (AF-3)

Response: *Any nonradiological discharges to the Mississippi River would be regulated through the facility's National Pollutant Discharge Elimination System permit. Pursuant to the Clean Water Act, the U.S. Environmental Protection Agency is responsible for administering the National Pollution Discharge Elimination System program. In Mississippi, the U.S. Environmental Protection Agency has delegated the responsibility for administering the National Pollution Discharge Elimination System program to the Mississippi Department of Environmental Quality. Radiological discharges, if any, to the Mississippi River would be regulated by the U.S. Nuclear Regulatory Commission. The staff concluded (see Section 5.3.3.4) that construction and operation of a plant at the Grand Gulf site would not jeopardize the water quality of the Mississippi River. This comment did not result in a change to the environmental impact statement.*

Comment: Page 2-25, Section 2.6.1.3 Hydrological Monitoring, second paragraph - There is only one gauging station at Vicksburg, with river stage currently being monitored by the U.S. Army Corps of Engineers (Corps) and reported on their website. The U.S. Geological Survey (USGS) ceased to operate the gauge, number 07289000 (not 0789000 as reported in the document), on September 30, 1998. The river stage information collected by the Corps also is reported on the USGS website for convenience. Corps website: http://www2.mvr.usace.army.mil/WaterContr01/stationinfo2.cfm?sid=CE40FF58&fid=VCKM6&d ~SUSGS website:http://nwis.waterdata.usgs.gov/nwis/nwism?siteno=O7289000&agency~cd=USGS (AH-3)

Response: *Section 2.6.1.3 of the environmental impact statement has been revised to only refer to the one currently operating gauge maintained by the U.S. Army Corps of Engineers at Vicksburg.*

Comment: The flow of the Mississippi River in the vicinity of the Grand Gulf site has shifted considerably to the east in the past 30 years, consuming 85 acres of land so that the site boundary line that originally abutted the bank of the river now extends halfway into the middle of the river (EIS § 2.7.1; Figure 2-4). Is it possible that the flow of this massive river could shift farther east in the next fifty years and intrude further upon the Grand Gulf site, even despite the revetments constructed by the Army Corps of Engineers? (AM-23)

Response: *The staff acknowledges that prior to the completion of the revetments erosion occurred that resulted in the Mississippi River encroaching on the Grand Gulf site. At least part, if not all, of that bank erosion was managed by the U.S. Army Corps of Engineers to revise the course of the Mississippi River. The staff also acknowledges that a severe flood on the Mississippi River could cause further alteration of the shoreline possibly encroaching further on the Grand Gulf site. While this is a consideration in the staff's safety analysis of the proposed early site permit facility, it is not an impact of the proposed project on the environment but an impact of the environment on the proposed plant. The impact of the environment on the ability of the proposed facility to function safely at the site is described in the safety evaluation report (NRC 2005). The commenter is referred to the discussion of channel diversions in Section 2.4 of the safety evaluation report. This comment did not result in a change to the environmental impact statement.*

Subject: Threatened or Endangered Species

Comment: Page 4-20, Line 25. The discussion of potential impacts to the threatened Louisiana black bear appears to be inconsistent. In the 2nd paragraph on page 4-20 the NRC states “In summary, the potential impact to the Louisiana black bear from construction at the Grand Gulf ESP site would be considered negligible.” The preferred habitat for the Louisiana black bear is bottomland hardwood, however, they may use upland forests that are adjacent to the bottomland hardwoods (see page 4-18). This discussion does not specifically include transmission line corridors, although, they are mentioned in the introduction to Section 4.4.3 (page 4-16). On page 5-25 (Section 5.4.3.1) the NRC states in the discussion of potential impacts to the Louisiana black bear, "Thus, the potential effect from operation of one or more cooling towers for the Grand Gulf ESP facility would be expected to be negligible. The Louisiana black bear would not be expected to be affected by transmission line operation and right-of-way maintenance." In section 7.4, the NRC describes the potential cumulative impacts to the Louisiana black bear (page 7-5, 2nd paragraph, line 15). They state "However, such an impact would be unlikely, given the relatively small amount of bottomland forested wetland that would be disturbed (22 ha [55 ac]). Nonetheless, because of the relatively large amount of forest (mostly upland) that would be disturbed by possible expansion of the GGNS Unit 1 power transmission corridors (427 ha [1056 ac]), the staff concludes that the overall contribution of construction to cumulative losses of important species and habitats in the region would be moderate." This conclusion does not follow directly from the preceding arguments. There is no information on the size of the trees in either the bottomland or upland forests. The Louisiana black bear dens in trees, primarily bald cypress and tupelo gum, with visible cavities, having a diameter at breast height of 3 feet and occurring along rivers, lakes, streams, bayous, sloughs, or other water bodies (page 4-19). It appears that additional information was taken into account when reaching the conclusion of moderate cumulative impacts that may not be included in the document. (AP-12)

Response: *The discussion of possible effects of transmission line right-of-way widening on Louisiana black bear habitat in Section 4.4.3.1 of the draft environmental impact statement was inadvertently omitted. Section 4.4.3.1 was revised to include the missing information. However, inclusion of this discussion does not change the estimated magnitude of construction impacts to the Louisiana black bear due to habitat loss (i.e., it will still be negligible as currently stated in Section 4.4.3.1). The wording in the draft environmental impact statement Section 7.4, Page 7-5, Lines 15-20 was confusing as to whether cumulative construction impacts to the Louisiana black bear would still be negligible in light of transmission line right-of-way widening. This text was revised to clarify that cumulative construction impacts to the Louisiana black bear would be negligible (even with revision of Section 4.4.3.1 to include the discussion of transmission line right-of-way widening). The finding of moderate cumulative construction impacts to overall terrestrial resources is due to the large area of forest, and thus a number of terrestrial species, including the Louisiana black bear, could be impacted by transmission line right-of-way widening. This comment resulted in a change to Sections 4.4.3.1 and 7.4.*

Comment: Endangered Species: We have determined that the federally-listed species listed under the Endangered Species Act (ESA) described below could be found in the proposed project area and could be affected by the proposed project.

The endangered interior least tern (*Sterna antillarum*) migrates up the Mississippi River and lays its eggs directly on the sandbars associated with the river. Hundreds of these birds may nest together to form a colony.

The endangered pallid sturgeon (*Scaphirhynchus albus*) is found in the lower Mississippi River, although it is rare throughout its range. These fish require large, turbid, free-flowing riverine habitats, and feed mainly on other fish. They are usually found near the bottom of streams or lakes in sand flats or gravel bars. Little information is known on spawning or migration habits of these fish, although spawning likely occurs in the spring and summer months.

The breeding/spawning season for terns and sturgeons is approximately May through July. Avoidance of these areas during the above time would prevent adverse impacts to either species. Both species can change nesting/spawning areas from year to year, so an onsite survey for both species just before start of construction is recommended.

The threatened Bayou darter (*Etheostoma rubrum*) is found only in Bayou Pierre and its tributaries: White Oak Creek, Foster Creek, and Turkey Creek. The darter prefers stable gravel riffles or sandstone exposures with large sized gravel or rock. Habitat loss or degradation has been a major contributor to the reduction in bayou darter numbers.

The endangered fat pocketbook mussel (*Potamilus capax*) has recently been found in the main channel of the lower Mississippi River. The fat pocketbook occurs primarily in sand and mud substrates, although the species has been found in fine gravel and hard clay occasionally. Water depth ranges from a few inches to several feet. The life cycle of fat pocketbooks is similar to that of other freshwater mussels. They are long-term brooders, with females becoming gravid in the fall, retaining glochidia over winter, and releasing the progeny during spring and summer. The fish host for this species is primarily freshwater drum. The greatest impact on the fat pocketbook throughout its historic range has been from activities resulting in the loss of habitat and a reduction in water quality.

The threatened bald eagle (*Haliaeetus leucocephalus*) is the only species of “sea eagle” regularly occurring on the North American continent. The bald eagle is predominantly a winter migrant in the southeast; however, increasing occurrences of nesting have been observed. The bald eagle nests in the transitional area between forest and water. They construct their nests in dominant living pines or bald cypress trees. Eagles often use alternate nests in different years with nesting activity occurring between September and January of each year. Young are usually fledged by midsummer.

The threatened Louisiana black bear (*Ursus a. luteolus*) occurs primarily in bottomland hardwood and floodplain forests along the Mississippi River and the southern part of the State. Although the bear is capable of surviving under a range of habitat types, some necessary habitat requirements include hard mast, soft mast, escape cover, denning sites, forested corridors, and limited human access. Forest management practices, agricultural, commercial and industrial development, and highways can cause adverse impacts to bear habitats by increasing human disturbance, fragmenting forests, and removing den trees.

All of the above listed species are very sensitive to human disturbance, and could be affected directly and also indirectly by the proposed project. Therefore, before the use or transportation of any heavy construction equipment, or the removal of any vegetation within potential habitats, the U.S. Fish and Wildlife Service recommends the following:

1. Onsite surveys for federally-listed species should be conducted prior to any construction activities.

2. Important fish and wildlife habitats (e.g., wetlands, fish spawning grounds) should be avoided during construction of the proposed project. If unavoidable adverse effects to important fish and wildlife habitats would result from this project, those impacts should be fully mitigated or compensated in-kind via close coordination with State and Federal resource agencies.

3. Existing water quality should be fully protected and maintained during construction, operation, and maintenance of the proposed project.

If a permit is required from a Federal agency for the proposed development, you must comply with Section 7 of the Endangered Species Act. The Federal agency, the U.S. Nuclear Regulatory Commission, must conduct an analysis of the proposed project for potential impacts to federally protected species. Using this analysis, the Federal agency (or its designated non-Federal representative) makes a determination of effect for federally-protected species. The Federal agency must make one of the following determinations: 1) no effect; 2) is not likely to adversely affect; or 3) is likely to adversely affect. “No effect” is the appropriate conclusion if the proposed action will not affect listed species. “Is not likely to adversely affect” is the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. “Is likely to adversely affect” is the appropriate conclusion if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions (50 CFR 402). If a “no effect” determination is made, the Federal agency is not obligated to contact the Service for concurrence. If a “not likely to adversely affect” determination is made, the Federal agency must contact the Service for written concurrence. If a determination of “likely to adversely affect” is made, the Federal agency must initiate formal consultation with the Service (See 50 CFR 402 for additional information). (AH-1)

Response: *The U.S. Fish and Wildlife Service and other Federal and State agencies were contacted regarding the occurrence of Federally listed species in the project area. The U.S. Nuclear Regulatory Commission informed the U.S. Fish and Wildlife Service (Jackson, Mississippi office) that a biological assessment of potential impacts to Federally listed species would not be developed for this environmental impact statement because the proposed action is an early site permit to bank the Grand Gulf site for possible construction of one or more new* *nuclear units. Pursuant to 10 CFR 52.18, the environmental review for an early site permit application focuses on the environmental effects of construction and operation of postulated reactors; however, SERI included no site redress plan in its application, therefore, no actual construction activities would be authorized at the Grand Gulf ESP site and no physical impacts would actually occur as a result of the action before the Commission. The action is purely administrative in nature. There will be no site preparation or construction activities resulting from the proposed action and thus no potential impacts to Federally listed species. Therefore, a Section 7 Consultation will not be initiated at this time.*

The known occurrences of and potential impacts to all the Federally listed species mentioned in the comment are described in the environmental impact statement. Should an early site permit be granted for the Grand Gulf early site permit site, and the permit holder subsequently submit an application to the U.S. Nuclear Regulatory Commission for a construction permit or combined license, environmental documentation would be prepared by the U.S. Nuclear Regulatory Commission for that application. This documentation would include the required biological assessment that would be submitted to the U.S. Fish and Wildlife Service under the Section 7 requirements of the Endangered Species Act. This comment did not result in a change to the environmental impact statement.

Subject: Uranium Fuel Cycle and Waste Management

Comment: The draft EIS estimates that, for the reference reactor-year (a 1000-MW(e) LWR), 1.1 million metric tons (MT) of raw ore would be required to produce 1200 MT of yellowcake for ultimate use as fuel after conversion, enrichment, and fabrication (EIS, § 6.1.2.5). Over time, as worldwide uranium ore supplies are depleted, requiring exploitation of less pure deposits of ore, would this ratio of ore to yellowcake increase? If so, would the environmental impacts of mining and milling become greater? (AM-14)

Response: *If less-pure ores are used, the ratio of raw ore to yellowcake would increase and the associated environmental impacts would increase proportionally. This also assumes that no new high-purity ore deposits are found and no fuel is reprocessed. The environmental impacts presented in the environmental impact statement were taken from Table S-3 of 10 CFR 51.51(a), which assumed conventional underground and strip mining of uranium ore. Two factors that will offset these increased impacts are (1) the increased reliance on in situ leach mining for uranium, and (2) increased reliance on foreign sources for uranium. In situ leach mining has fewer environmental impacts compared to underground and strip mining of the ore because (1) the dusty ore crushing process is not needed and (2) extensive waste tailings are not generated. All steps in the in situ leach mining operation have the uranium in a less dispersible liquid form. In 2001 and 2002, the last years with reportable data, all the uranium produced in the United States was from in situ leaching operations (Uranium Industry Annual*

2002, May 2003). This same report indicated that foreign-origin uranium accounted for 88 percent of the uranium purchases for U.S. civilian nuclear power plants in 2002. This comment did not result in a change to the environmental impact statement.

Comment: I think we are foolhardy in this country to expand nuclear power plants when we have no idea (regarding safe disposal) what we are doing with waste, transporting waste, and safeguarding plants, to say nothing of the fact that this plant is upriver from New Orleans. (AF-2)

Response: *Section 3.2.3 addresses solid waste management. Because a specific reactor design has not been determined and because the plant parameter envelope concept was used, System Energy Resources, Inc. did not specify solid radioactive waste management practices; however, a bounding total annual volume of solid radioactive waste was estimated. Regarding spent nuclear fuel, the U.S. Nuclear Regulatory Commission's Waste Confidence Rule, found in 10 CFR 51.23, states:*

> *The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.*

In its Statement of Considerations for the 1990 update of the Waste Confidence Rule (55 FR 38472), the Commission addressed the impacts of the disposal of spent fuel discharged from the current fleet of reactors operating under existing and renewed licenses and from a new generation of operating reactors. Therefore, the current rule covers new reactors and applies to the staff's review of an early site permit or a combined license application. The rule was last reviewed by the Commission in 1999 when it reaffirmed the findings in the rule (64 FR 68005, dated December 6, 1999). Furthermore, the Atomic Safety and Licensing Board presiding over the proceeding on the Grand Gulf early site permit application affirmed that the Waste Confidence Rule and its subsequent amendments clearly include waste produced by a new generation of reactors. (Dominion 2005).

Comment: The draft EIS only considers the "no recycle" option for irradiated fuel management, which treats spent fuel as waste to be stored at a federal waste repository, and does not fully consider the possible reprocessing of spent nuclear fuel (EIS, pg. 6-5). But, as mentioned above, the DOE has had significant setbacks in its attempt to attain a license for a federal repository for irradiated nuclear fuel at Yucca Mountain, and the federal policy banning the reprocessing of spent nuclear fuel far from intractable. In fact, the DOE was granted more than $67 million in fiscal year (FY) 2005 for the "Advanced fuel cycle initiative," a research and development program intended to provide technology to "recover the energy content in spent nuclear fuel," and it has requested $70 million from Congress for FY 2006 for the same program. This continued government interest in reprocessing, combined with the failure to establish a national repository for irradiated nuclear fuel, should compel the NRC to consider the impacts of spent fuel reprocessing in the final EIS. (AM-12)

Response: *Federal policy does not prohibit reprocessing; however, reprocessing is unlikely in the foreseeable future (NEPDG 2001). Table S–3 from 10 CFR 51.51 does include impacts from reprocessing. Per Section 6.1 of the environmental impact statement, the contributions in Table S–3 for reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle); that is, the cycle that results in the greater impact is used. As discussed in the environmental impact statement, 10 CFR 51.51(a) allows the applicant to use Table S–3 as the basis for evaluating the contribution of the environmental effects of the uranium fuel cycle that includes reprocessing. Section 6.1 of the environmental impact statement was modified to indicate that Federal policy does not prohibit spent fuel reprocessing. This comment resulted in a change to Section 6.1.*

Comment: In addition, the second alternative poses potential long term environmental, public health and economic issues for nearby EJ populations. Nuclear waste storage issues may be a relatively important issue for residents within the immediate surrounding areas. (AZ-10)

Response: *Regarding environmental justice, the comment has no specific recommendations for additional analysis. The U.S. Nuclear Regulatory Commission's Waste Confidence Rule, found in 10 CFR 51.23, states:*

> *the Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.*

In its Statement of Considerations for the 1990 update of the Waste Confidence Rule (55 FR 38472), the Commission addressed the impacts of the disposal of spent fuel discharged from the current fleet of reactors operating under existing and renewed licenses and from a new generation of operating reactors. Therefore, the current rule covers new reactors and is applicable to the staff's review of an early site permit application. The rule was last reviewed by the Commission in 1999 when it reaffirmed the findings in the rule (64 FR 68005, dated December 6, 1999). Furthermore, the Atomic Safety and Licensing Board presiding over the proceeding on the Grand Gulf early site permit application affirmed that the Waste Confidence Rule and its subsequent amendments resolve issues associated with long-term disposal of high-level waste as they relate to future reactors (SERI 2004). This comment did not result in a change to the environmental impact statement.

Comment: The draft EIS lacks a consideration of the environmental and public health impacts resulting from military applications of depleted uranium (DU), a byproduct of the enrichment process of the fuel cycle. Moreover, there is not a complete consideration of the impacts of managing this substance as a waste. There is no repository established for the permanent disposal of depleted uranium, but the impacts of such a hypothetical facility should be considered. (AM-13)

Response: *The environmental and public health impacts resulting from military applications of depleted uranium and deposition of depleted uranium waste are beyond the scope of the environmental impact statement. This comment did not result in a change to the environmental impact statement.*

Comment: Nuclear Power is Too Polluting: Beyond operating concerns remains the unsolved and disturbing issue of waste disposal. Some 95% of the radioactivity ever generated in the U.S. is contained in the nation's civilian high-level atomic waste. Despite almost two decades of pushing to make Yucca Mountain in Nevada the nation's high-level waste repository, it has not been shown scientifically to be suitable to safely store the waste. The Yucca Mountain project is further thrown into doubt by the recent revelations of the falsification of scientific data by USGS scientists, as well as the court ruling that found EPA's public health standards for the site to be illegal. No country in the world has solved its nuclear waste problem. It makes little sense to begin building new reactors when we don't know what to do with the lethal waste from the ones we have. (AC-7)

Comment: Entergy has produced no evidence that they can secure its wasteful production for the entire life and through its de-commissioning. Entergy has produced no evidence that future generations will honor its wasteful protection promises. (AJ-2)

Comment: Nuclear generated electricity that must, of necessity, be produced in large and costly centralized power plants that produce enormous amounts of highly radioactive wastes –

wastes that neither the government nor the private utility industry, has accepted responsibility for in the long-term. These wastes continue to be stored, above ground, at the plant sites where they were generated thus turning these sites into relatively insecure nuclear waste dumps. This is akin to disposing of household sanitary wastes in a concrete lined pit in the backyard of our homes—an act that is illegal in most places. (AK-2)

Comment: The NRC's assumption that "no [radioactive] release to the environment is expected" (EIS, pg. 6-12) at deep repositories like Yucca Mountain is unfounded; rather, the geologic integrity of this site is far from proven. Moreover, the Department of Energy (DOE) has not yet submitted its license application to the NRC, although the statutory deadline was more than two years ago. DOE was supposed to begin accepting waste in 1998 and is highly unlikely to meet its revised goal of accepting waste by 2012. (AM-10)

Comment: Even if Yucca Mountain is opened, the site cannot hold the high-level radioactive waste that will be generated by existing reactors after 2010. Therefore, in addition to the waste generated by existing reactors, waste created by a new nuclear unit at the GGNS would also have to remain onsite for an indefinite period of time, though SERI has admitted that by 2007 it will no longer have the onsite capacity to handle the waste produced by the existing reactor at the GGNS. The NRC recently approved an unprecedented 40-year license extension for the nuclear operator Dominion to store high-level nuclear waste on-site at its Surry nuclear plant near Williamsburg, Virginia, indicating that fuel can reasonably be expected to be stored at reactor sites for at least that long. The environmental impacts of indefinite storage must be thoroughly evaluated in the final EIS. (AM-11)

Comment: Safety issues are another major concern. The continued generation of highly toxic and long-lived nuclear wastes should be stopped. There is yet no national waste repository, resulting in the current storage of 20 years of waste above ground and on site at GGNS, with more waste being continually generated. Entergy has stated that its current storage capacity will be filled in 2007 and plans are being made to store future waste above ground in concrete casks that last one hundred years. As NRC commissioners and staff know, many of the isotopes generated by nuclear fission last for tens of thousands of years, some for millions of years. To generate more waste without a safe way to deal with it is madness, highly irresponsible, and not in the best interests of the People of the United States, particularly when viable alternatives exist. We can't even build a house in this country without adequate waste disposal, yet we are considering building and continue to use facilities that will generate tons of these highly radioactive and deadly materials. No new nuclear reactors should even be considered, and those currently on line should be gradually phased out. If a national repository is ever created, the tens of thousands of tons of waste already generated will be transported by rail, truck, and barge across the country, providing targets for terrorists and danger to the public from accidents. (AN-2)

Comment: The environmental impacts from the proliferation of nuclear waste has been trivialized and ignored. The DEIS identifies the environmental risk from the additional high-level nuclear waste generated at the site as “small.” The Commission staff acknowledges in the DEIS that for the high-level nuclear waste disposal component of the nuclear fuel cycle, there is “uncertainty” with respect to offsite releases of radiation from a federal repository potentially sited at Yucca Mountain, Nevada. Yucca Mountain is the only site under characterization and before an Atomic Safety and Licensing Board. The DEIS states that staff is relying upon the NRC “Waste Confidence Decision” that a nuclear waste repository can and likely will be developed at some site that will comply with standards and limits for peak radiation exposures to U.S. populations. However, NRC DEIS has failed to quantify the acknowledged “uncertainty.” In fact, the uncertainty is considerably greater than even the NRC is willing to acknowledge. Total commercial high-level radioactive waste generated at the Grand Gulf nuclear power station Unit 1 will surpass the currently established technological limits for modeling the environmental capacity of the proposed Yucca Mountain repository. In the year 2011, the current US reactors will have generated more than 63,000 metric tons of commercial high-level radioactive waste, enough to fill Yucca Mountain even if it should successfully be licensed, constructed and opened. All waste generated after 2011 will be in excess to Yucca Mountain. Any additional high-level nuclear waste (HLRW) generated in Mississippi at the Grand Gulf unit 1 site will be in excess to Yucca Mountain. To date, Grand Gulf has generated 664 metric tons of HLRW. By 2011, Unit 1 will have generated 856 metric tons of HLRW. Should Grand Gulf Unit 1 receive a twenty-year license extension by 2045 it will have generated 1074 metric tons in excess to Yucca Mountain. If Grand Gulf is operated for 60 years and two additional reactors are built and operated for 60 years, the total amount of HLRW in excess to Yucca Mountain at Grand Gulf site would then be approximately 4,900 metric tons or more that seven times what is currently stored there. Given that the acknowledged “uncertainty” includes the fact that NRC and the nuclear industry have failed to provide a scientifically accepted long-term HLRW management plan with a scientifically accepted site for the first cupful of radioactive waste generated more than a half century ago, NRC should reject the SERI application which would potentially exacerbate the environmental damage from an incomplete and unanalyzed high-level nuclear waste management plan for the additional and excess HLRW generated by the new units. (AR-5)

Comment: Radiation Concerns regarding Contingency for Storing Spent Nuclear Fuel Onsite: Given the uncertainty of licensing the Yucca Mountain Nevada facility for the storage of spent nuclear fuel, all utilities planning on constructing additional nuclear units on current sites should plan on the contingency of having to store waste onsite for an extended period of time. (AZ-2)

Comment: Based on the DEIS, it is unclear where the radioactive waste from the Grand Gulf Reactors will reside. Yucca Mountain and on-site storage were the two alternatives discussed in the DEIS. The first alternative is currently closed and the second alternative does not have the capacity for long-term storage (2007 for the current nuclear reactor). (AZ-9)

Comment: But there is one other point that I'd like to raise here in my remaining time, and that is the fact that the DEIS has also trivialized the known and harmful environmental impacts of new nuclear waste generation, with the proposed expansion of the Grand Gulf Nuclear Power Station. In the year 2011, the current nuclear reactors will have generated more than 63,000 metric tons of commercial high level radioactive waste, enough to fill Yucca Mountain, which is the only site that the country's currently looking at, to its legal limit. The waste generated after 2011 will be excess to Yucca Mountain, and stuck in Mississippi, even if Yucca were to open an fill to capacity. Now let's look at some of those figures real quick here in the closing time that I have. Between 1985 and 2005, Grand Gulf Unit 1, generated 664 metric tons. Between 1985 and 2011, that'll be 856 metric tons; by 2035, that'll 1600 tons; by 2045, if the plant applies and is granted a 20 year extension, that will be over 1900 tons. And that figure is 1,074 metric tons in excess of Yucca Mountain. If you add Grand Gulf Unit 2, and Grand Gulf Unit 3, those totals go up to 3,840 tons. (H-4)

Comment: First, the nuclear waste problem ongoing for the past at least thirty years has not been solved. Do we assume it will be solved in the near future? How can the environmental impact be determined to be insignificant until this problem is solved? (W-2)

Comment: Is the nuclear waste being stored at the plant? Do we have a plan about what to do with this waste? (Y-2)

Comment: When someone comes up with a way to store this waste (which is not under a mountain) then one might start to even think of such a thing. (AA-3)

Comment: The draft EIS fails to evaluate the environmental impacts and security threat of indefinitely storing the additional irradiated fuel that would be generated by the proposed additional nuclear unit onsite. Another nuclear unit at the GGNS could create annually 20 to 30 metric tons of additional irradiated fuel, yet in its application SERI has not even identified radioactive waste management systems for any new nuclear facilities at the site (EIS, pg. 3-11). Despite the NRC's Waste Confidence Decision, the only national repository site under consideration, Yucca Mountain in Nevada, is far from a done deal. Numerous scientific questions remain about whether the site can safely store waste, and, recently, a scandal has erupted over the possible falsification of scientific studies used to justify the geologic suitability of the site. (AM-9)

Comment: At the last meeting we had here in this room, and official from Entergy was asked how long – when the storage of the nuclear waste at Grand Gulf would reach capacity. And he responded, 2007. With that cut off period, I don't understand how we can continue to talk about generating yet more waste when we're going to reach our local capacity in 2007, and we know that even if Yucca Mountain were used, it would reach its capacity by 2011. So for me it seems like a no brainer. It's the waste, it's the waste, it's the waste. (N-1)

Comment: What will happen with the inevitable radioactive waste products? It will be around for many, many lifetimes. (X-4)

Comment: The draft EIS fails to evaluate the environmental impacts and security threat of indefinitely storing the additional irradiated fuel that would be generated by the proposed additional nuclear unit onsite. Yucca Mountain in Nevada is far from a done deal. Numerous scientific questions remain about whether the site can safely store waste and recently a scandal has erupted over the possible falsification of scientific studies used to justify the geologic suitability of the site. The environmental impacts of indefinite storage must be thoroughly evaluated in the final EIS. (BB-5, BC-2, BD-6, BG-6, BJ-7, BK-3, BL-6, MM-6)

Comment: My main concern on Nuclear power is that we have not found a suitable way to dispose of the nuclear waste created during the making of electricity. Currently we are using dump sites that are not secure and the proposal to use the Yucca Mountain Nevada site is unacceptable because it is so far from all of the Nuclear plants that it would pose a hazard to peoples in the many states through which the waste would have to travel to dump in NV, to say nothing of the environmental impact in the immediate surrounding area to the dump site. (BE-2)

Comment: But the main reason for my opposition is that our main means of disposing of nuclear waste currently involves using it in weapons as “depleted” uranium. That term depleted drives me nuts because it is like saying that a woman is kinda pregnant. The damage that we are doing to our own soldiers as well as to innocent people in other countries as well as to their environment will be on our conscience long after the holocaust is forgotten. (BE-3)

Comment: New nuclear plants are very unwise seeing that we can't even find a good place for the nuclear waste that has already been generated. From things I have read in the past, Yucca Mountain will not be big enough to hold all the nuclear waste already generated by the 100 nuclear plants that already exist. There are also earthquake faults at Yucca Mt. I read that the data about Yucca Mt. storage was improperly prepared. (BF-5)

Comment: The draft EIS fails to evaluate the environmental impacts and security threat of indefinitely storing the additional irradiated fuel that would be generated by the proposed additional nuclear unit onsite. Yucca Mountain in Nevada is not necessarily going to be available. Numerous scientific questions remain about whether the site can safely store waste. This is further complicated by the recent scandal over possible falsification of the scientific studies used to justify the geologic suitability of the site. The environmental impacts of indefinite storage must be thoroughly evaluated in the final EIS. (BH-6)

Comment: Nuclear energy is too risky for everyone. Storage of the radioactive waste is another whole can of worms. (BI-4)

Response: *The U.S. Nuclear Regulatory Commission's Waste Confidence Rule, found in 10 CFR 51.23, states:*

> *the Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.*

In its Statement of Considerations for the 1990 update of the Waste Confidence Rule (55 FR 38472), the Commission addressed the impacts of the disposal of spent fuel discharged from the current fleet of reactors operating under existing and renewed licenses and from a new generation of operating reactors. Therefore, the current rule covers new reactors and is applicable to the staff's review of an early site permit application. The rule was last reviewed by the Commission in 1999 when it reaffirmed the findings in the rule (64 FR 68005, dated December 6, 1999). Furthermore, the Atomic Safety and Licensing Board presiding over the proceeding on the Grand Gulf early site permit application affirmed that the Waste Confidence Rule and its subsequent amendments resolve issues associated with long-term disposal of high-level waste as they relate to future reactors (SERI 2004). These comments did not result in a change to the environmental impact statement.

Comment: Page 3-11, Line 4-10. Text says: "Bounding effluent concentrations were determined, based on a composite of the highest activity content of the individual isotopes from two surrogate AP1000 reactors (6400 MW(t)), three IRIS reactors (3000 MW(t)), one ABWR reactor (3926 MW(t)), one ESBWR reactor (4000 MW(t)), four GT-MHR modules (2400 MW(t)), and eight PBMR modules (3200 MW(t)). Bounding gaseous effluent releases are found in Table 3.0-7 of the Grand Gulf ESP environmental report (SERI 2003c). Bounding liquid effluent releases are found in Table 3.0-8 of the environmental report (SERI 2003c)."

This is not completely correct. Liquid releases were determined as follows: As several different plant types are under consideration for the proposed site, a composite release that bounds the potential release from two (2) ABWR units, two (2) AP1000 units and four (4) ACR700 plant types was used. Annual average liquid releases for each of these plant types were compared. The most limiting isotopic releases were identified and then included in the composite release.

Note: Westinghouse International Reactor Innovative and Secure (IRIS) specific release information was not available. The AP1000 data was assumed to bound the releases from 3 single IRIS units (3000 MWt, 1005 MWe).

Gaseous releases were determined as follows: The types of reactors from which the bounding parameters were determined, are:

- Advanced Boiling Water Reactor (ABWR) – 2 units
- Advanced Pressurized Water Reactor (AP1000) – 2 units
- Gas Turbine-Modular Helium Reactor (GT-MHR) – 8 modules
- Advanced Canada Deuterium Uranium (CanDU) Reactor (ACR-700) – 4 units
- International Reactor Innovative and Secure (IRIS) – 6 units.

The activity of radionuclides released is obtained from a composite of the releases for each evaluated plant type. For each radionuclide, the highest release for any proposed plant was used for the source term. Also, the thermal power for the ABWR was assumed to be 4300 MWt (assuming a ~10% power uprate from the nominal 3926 MWt). (AP-9)

Response: *The statements regarding the bounding gaseous and liquid effluents were revised in Chapter 3 of the environmental impact statement. This comment resulted in a change to Chapter 3.*

Comment: Transportation Accidents (§ 6.2): This section and the accompanying Appendix H of the draft EIS do not give adequate weight and consideration to the possibility and consequences of severe accident scenarios resulting from the transportation of spent nuclear fuel. The possibility of extreme accidents, while slight, exists, as evidenced by recent incidents such as the Baltimore train tunnel fire of 2001 and the more recent accident in Graniteville, South Carolina in January, where a violent train crash and release of chlorine killed nine people, sent hundreds to the hospital, and required thousands to evacuate their homes. (AM-15)

Response: *The transportation impact analysis in Section 6.2 and Appendix H of the draft environmental impact statement analyzed the full spectrum of transportation accidents, from minor fender-benders to severe collisions and fires. Detailed supporting studies for the accident frequencies, conditional probabilities, and releases from potential spent fuel transportation accidents formed the basis for the analysis of transportation accidents in the environmental impact statement. The U.S. Nuclear Regulatory Commission has sponsored studies to analyze the consequences of specific accident scenarios on rail and truck transportation casks carrying spent fuel. For example, the U.S. Nuclear Regulatory Commission undertook an investigation of a July 2001 accident that involved a freight train carrying hazardous materials derailing and catching fire while passing through the Howard Street railroad tunnel in downtown Baltimore, Maryland, to determine the possible regulatory* *implications of this particular event for the transportation of spent fuel by railroad. The U.S. Nuclear Regulatory Commission assembled a team of experts from the National Institute of Standards and Technology, Center for Nuclear Waste Regulatory Analyses, and Pacific Northwest National Laboratory to determine the thermal conditions that existed in the Howard Street tunnel fire and to analyze the effects of this fire on various spent fuel transportation cask designs. The staff concluded that the spent fuel transportation casks analyzed would withstand a fire with thermal conditions similar to those that existed in the Baltimore tunnel fire event. No release of radioactive materials would result from exposure of the spent fuel transportation casks exposed to such an event. This comment did not result in a change to the environmental impact statement.*

Comment: The waste issue is one of the biggest things going for nuclear power, because it generates massive amounts of electricity for such a small amount of waste. If anything, this draft environmental impact statement needs to address the environmental impact of not building new nuclear reactors, because the power will still be needed, and it would likely be from more environmentally harmful sources than nuclear power. (P-2)

Comment: I'm going to carry on with Michael's thoughts, you know, about nuclear use, nuclear fuel, nuclear waste, nuclear garbage, whatever you want to call it. I'd like to maybe ask you to re-think your perception about it. I consider that to be a – you know, not bragging or anything, but I think it's something – I think it's a positive point. Something we should be proud of. I think if we continue that behavior, being responsible with the stuff that gets produced from our commercial activity, that that's a good sign, that's something that everybody here should be glad that we do. And that there are other industries in this country unfortunately that do not follow that example. We should all work towards trying to apply these standards to those other industries. I think that would do our nation a great deal of good. (S-2)

Response: *These comments provide no new information for additional analysis. These comments did not result in a change to the environmental impact statement.*

References

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

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." Available at http://www.gpoaccess.gov/cfr/index.html.

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties," Section 800.8, "Coordination with the National Environmental Policy Act."

40 CFR Part 1502. Code of Federal Regulations, Title 40, *Protection of the Environment*, (Environmental Impact Statement), Part 1502, Section 1502.14, "Alternatives Including the Proposed Action."

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

43 FR 55978-56007. November 29, 1978. "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act." *Federal Register*.

46 FR 18027. March 23, 1981. "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations." *Federal Register.*

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Appendix F

Key Correspondence

Appendix F

Key Correspondence

Key correspondence during the evaluation process of the early site permit (ESP) application submitted by System Energy Resources, Inc., (SERI) for the Grand Gulf ESP site is identified in Table F-1. Copies of the correspondence are included at the end of this appendix.

Table F-1. Key Early Site Permit Consultation Correspondence

Date of Letter (Accession No.)	Topic	Source	Recipient
January 6, 2004 (ML040081014)	Letter requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Claiborne County, Mississippi and West Feliciana Parish, Louisiana	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	National Oceanic and Atmospheric Administration Fisheries Southeast Regional Office (G. Cranmore)
January 6, 2004 (ML040081042)	Letter informing of NRC's review of the ESP application submitted by SERI and stating that the subsequent EIS will include analyses of potential impact to historic and cultural resources	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Office of Federal Agency Programs Advisory Council on Historic Preservation (D. Klima)
January 6, 2004 (ML040081119)	Letter requesting a list of endangered, threatened, and candidate or proposed species and critical habitat that are known to occur or could potentially occur in Oswego County, New York	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	U.S. Fish and Wildlife Service New York Ecological Services Office (D. Stilwell)
January 6, 2004 (ML040081088)	Letter requesting a list of endangered, threatened, candidate, and proposed species and critical habitat that are known to occur or could potentially occur in Oswego County, New York and Plymouth County, Massachusetts	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	National Oceanic and Atmospheric Administration Fisheries Northeast Regional Office (P. Kurkul)

Table F-1. (contd)

Date of Letter (Accession No.)	Topic	Source	Recipient
January 6, 2004 (ML040081108)	Letter requesting a list of endangered, threatened, candidate, and proposed species and critical habitat that are known to occur or could potentially occur in Plymouth County, Massachusetts	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	U.S. Fish and Wildlife Service New England Ecological Services Office (M. Bartlett)
January 8, 2004 (ML040090099)	Letter requesting a list of endangered, threatened, candidate, and proposed species and critical habitat that are known to occur or could potentially occur in Claiborne County, Mississippi	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	U.S. Fish and Wildlife Service Mississippi Ecological Services Office (R. Aycock)
January 8, 2004 (ML040090125)	Letter inviting Mississippi Department of Archives and History staff to participate in the review of the Grand Gulf ESP application	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Federal and State Review Program Mississippi Department of Archives and History (T. Wagner)
January 8, 2004 (ML040090141)	Letter requesting a list of endangered, threatened, candidate, or proposed species and critical habitat that are known to occur or could potentially occur in West Feliciana Parish, Louisiana	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	U.S. Fish and Wildlife Service Louisiana Ecological Services Office (R. Watson)
January 8, 2004 (ML040090292)	Letter inviting participation in the environmental scoping process for the Grand Gulf ESP review	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Mississippi Band of Choctaw Indians (P. Martin)
January 8, 2004 (ML040090309)	Letter inviting participation in the environmental scoping process for the Grand Gulf ESP review	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Choctaw Nation of Oklahoma (G. E. Pyle)
January 8, 2004 (ML040090330)	Letter inviting participation in the environmental scoping process for the Grand Gulf ESP review	U.S. Nuclear Regulatory Commission (P.-T. Kuo)	Tunika Biloxi Indian Tribe of Louisiana (E. J. Barbry, Jr.)
January 21, 2004 (ML040260250)	Letter responding to a January 8, 2004 NRC letter requesting a list of threatened and endangered species. Provides list of threatened and endangered species that could be found near the Grand Gulf site	U.S. Fish and Wildlife Service Mississippi Field Office (C. B. James)	U.S. Nuclear Regulatory Commission (P.-T. Kuo)

Table F-1. (contd)

Date of Letter (Accession No.)	Topic	Source	Recipient
January 26, 2004 (ML040370323)	Letter responding to a January 6, 2004 NRC letter that requested a list of threatened and endangered species. No threatened or endangered species live in the vicinity of the FitzPatrick Nuclear Power Plant, in Scriba, Oswego County, New York	U.S. Fish and Wildlife Service New York Field Office (D. A. Stilwell)	U.S. Nuclear Regulatory Commission (P.-T. Kuo)
January 28, 2004 (ML040350504)	Letter responding to a January 6, 2004 NRC letter that requested a list of threatened and endangered species. Provides a list of threatened and endangered species under NOAA Fisheries jurisdiction in the vicinity of the Grand Gulf and alternate sites.	National Oceanic and Atmospheric Administration Fisheries Northeast Regional Office (M. A. Colligan)	U.S. Nuclear Regulatory Commission (P.-T. Kuo)
February 5, 2004 (ML040500681)	Letter responding to a January 8, 2004 NRC letter requesting a list of threatened and endangered species. Provides a list of threatened and endangered species in West Feliciana Parish, Louisiana	U.S. Fish and Wildlife Service Louisiana Field Office R. C. Watson)	U.S. Nuclear Regulatory Commission (P.-T. Kuo)
February 9, 2004 (ML040650620)	Letter providing a list of threatened and endangered species for Plymouth County, Massachusetts	U.S. Fish and Wildlife Service New England Field Office (M. J. Amaral)	U.S. Nuclear Regulatory Commission (P.-T. Kuo)
April 14, 2004 (ML041310449)	Letter adding one more species to the list of threatened and endangered species in Claiborne County, Mississippi	U.S. Fish and Wildlife Service Mississippi Field Office (C. B. James)	U.S. Nuclear Regulatory Commission (M. T. Masnik)

Accession No. ML040081014

January 6, 2004

Ms. Georgia Cranmore
Assistant Regional Administrator
NOAA Fisheries Southeast Regional Office
9721 Executive Center Drive North
Saint Petersburg, FL 33702

SUBJECT: APPLICATION FOR AN EARLY SITE PERMIT FOR THE GRAND GULF SITE

Dear Ms. Cranmore:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the potential future construction of one or more new nuclear power plants. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). The impact analysis in the EIS includes the potential impacts of the construction and operation of a new nuclear power plant at the preferred or alternate sites, including the potential impacts to fish and wildlife and threatened and endangered species.

SERI's preferred location for the proposed new power plant(s) is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Claiborne County, Mississippi. Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; Fitzpatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The application for an ESP was submitted by System Energy Resources, Inc. (SERI) on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR 52). If approved, the ESP will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. The ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

To support the EIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act of 1973, the NRC requests a list of endangered, threatened, candidate, or proposed species and critical habitat that are known to occur or could potentially occur in Claiborne County, Mississippi and West Feliciana County, Louisiana. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act of 1934.

Accession No. ML040081014

G. Cranmore 2

If you have any questions concerning the ESP application, or other aspects of this project, please contact Ms. Cristina Guerrero, at (301) 415-2981 or by e-mail at CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 52-009

Accession No. ML040081042

January 6, 2004

Mr. Don Klima, Director
Office of Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 809
Washington, DC 20004

SUBJECT: EARLY SITE PERMIT REVIEW FOR THE GRAND GULF SITE

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application for an early site permit (ESP) submitted by System Energy Resources, Inc. (SERI) on October 16, 2003. An ESP allows an applicant to set aside a site for potential future construction of one or more new nuclear power plants, and provides the opportunity to resolve site safety and environmental issues before construction begins. An ESP does not allow actual construction of a nuclear plant, which must be requested through another application. The ESP site proposed by SERI is on property co-located with the existing Grand Gulf Power Station site near the town of Port Gibson in Claiborne County, Mississippi. The application was submitted by SERI pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR Part 52).

As part of its review of the application, the NRC staff will prepare an environmental impact statement (EIS) pursuant to 10 CFR Part 51, the NRC regulations that implement the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the EIS will include analyses of potential impacts to historic and cultural resources. A draft EIS is scheduled for publication in February 2005, and will be provided to you for review and comment.

If you have any questions or require additional information, please contact Ms. Cristina Guerrero at 301-415-2981 or CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-009

Accession No. ML040081119

January 6, 2004

Mr. David Stilwell, Field Office Supervisor
U.S. Fish and Wildlife Service
New York Ecological Services Office
3817 Luker Road
Cortland, NY 13045

SUBJECT: APPLICATION FOR AN EARLY SITE PERMIT (ESP) FOR THE GRAND GULF ESP SITE

Dear Mr. Stilwell:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the potential future construction of one or more new nuclear power plants. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). The impact analysis in the EIS includes the potential impacts of the construction and operation of a new nuclear power plant at the preferred or alternate sites, including the potential impacts to fish and wildlife and threatened and endangered species.

SERI's preferred alternative for the location of the proposed new power plant(s) is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Claiborne County, Mississippi. Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; FitzPatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The application for an ESP was submitted by SERI on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR 52). If approved, the ESP will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. The ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act of 1973, the NRC requests a list of endangered, threatened, candidate, and proposed species and critical habitat that are known to occur or could potentially occur in Oswego County, New York. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act of 1934.

Accession No. ML040081119

D. Stilwell 2

If you have any questions concerning the ESP application, or other aspects of this project, please contact Ms. Cristina Guerrero, at (301) 415-2981 or by e-mail at CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 52-009

Accession No. ML040081088

January 6, 2004

Ms. Patricia Kurkul
Regional Administrator
NOAA Fisheries Northeast Regional Office
1 Blackburn Drive
Gloucester, MA 01930

SUBJECT: APPLICATION FOR AN EARLY SITE PERMIT (ESP) FOR THE GRAND GULF ESP SITE

Dear Ms. Kurkul:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the potential future construction of one or more new nuclear power plants. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). The impact analysis in the EIS includes the potential impacts of the construction and operation of a new nuclear power plant at the preferred or alternate sites, including the potential impacts to fish and wildlife and threatened and endangered species.

SERI's preferred alternative for the location of the proposed new power plant(s) is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Claiborne County, Mississippi. Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; FitzPatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The application for an ESP was submitted by System Energy Resources, Inc. (SERI) on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR 52). If approved, the ESP will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. The ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act of 1973, the NRC requests a list of endangered, threatened, candidate, and proposed species and critical habitat that are known to occur or could potentially occur in Oswego County, New York and Plymouth County, Massachusetts. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act of 1934.

Accession No. ML040081088

P. Kurkul 2

If you have any questions concerning the ESP application, or other aspects of this project, please contact Ms. Cristina Guerrero, at (301) 415-2981 or by e-mail at CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 52-009

Accession No. ML040081108

January 6, 2004

Mr. Mike Bartlett, Field Office Supervisor
U.S. Fish and Wildlife Service
New England Ecological Services Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087

SUBJECT: APPLICATION FOR AN EARLY SITE PERMIT (ESP) FOR THE GRAND GULF ESP SITE

Dear Mr. Bartlett:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the potential future construction of one or more new nuclear power plants. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). The impact analysis in the EIS includes the potential impacts of the construction and operation of a new nuclear power plant at the preferred or alternate sites, including the potential impacts to fish and wildlife and threatened and endangered species.

SERI's preferred alternative for the location of the proposed new power plant(s) is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Claiborne County, Mississippi. Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; FitzPatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The application for an ESP was submitted by SERI on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR 52). If approved, the ESP will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. The ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

To support the environmental impact statement preparation process and to ensure compliance with Section 7 of the Endangered Species Act of 1973, the NRC requests a list of endangered, threatened, candidate, and proposed species and critical habitat that are known to occur or could potentially occur in Plymouth County, Massachusetts. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act of 1934.

Accession No. ML040081108

M. Bartlett 2

If you have any questions concerning the ESP application, or other aspects of this project, please contact Ms. Cristina Guerrero, at (301) 415-2981 or by e-mail at CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 52-009

Accession No. ML040090099

January 8, 2004

Mr. Ray Aycock, Field Supervisor
U.S. Fish and Wildlife Service
Mississippi Ecological Services Office
6578 Dogwood View Parkway
Jackson, MS 39213

SUBJECT: APPLICATION FOR AN EARLY SITE PERMIT FOR THE GRAND GULF SITE

Dear Mr. Aycock:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the potential future construction of one or more new nuclear power plants. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). The impact analysis in the EIS includes the potential impacts of the construction and operation of a new nuclear power plant at the preferred or alternate sites, including the potential impacts to fish and wildlife and threatened and endangered species.

SERI's preferred location for the proposed new power plant(s) is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Claiborne County, Mississippi. Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; Fitzpatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The application for an ESP was submitted by SERI on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR 52). If approved, the ESP will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. The ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

To support the EIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of endangered, threatened, candidate, or proposed species and critical habitat that are known to occur or could potentially occur in Claiborne County, Mississippi. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act of 1934.

Accession No. ML040090099

If you have any questions concerning the ESP application, or other aspects of this project, please contact Ms. Cristina Guerrero, at (301) 415-2981 or by e-mail at CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 52-009

Accession No. ML040090125

January 8, 2004

Mr. Tom Wagner
Federal and State Review Program
Interagency Coordinator
Mississippi Department of Archives and History
Historic Preservation
P. O. Box 571
Jackson, MS 39205-0571

SUBJECT: EARLY SITE PERMIT (ESP) REVIEW FOR THE GRAND GULF SITE

Dear Mr. Wagner:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application for an ESP to set aside a site for the potential future construction of one or more new nuclear power plants. The NRC staff is currently seeking information from consulting parties, and other individuals and organizations likely to have knowledge of, or concerns with, historic properties in the area, to identify issues relating to the proposed undertaking's potential effects on historic properties.

If built, the new unit(s) would be co-located with the existing Grand Gulf Nuclear Power Station (GGNS) site near the town of Port Gibson in Claiborne County, Mississippi. The application for an ESP was submitted by System Energy Resources, Inc, (SERI), on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR Part 52). The application is available through the web-based version of the NRC's Agencywide Documents Access and Management System (ADAMS) which can be found at http://www.nrc.gov/reading-rm/adams.html. The application is listed under Accession Number ML032960315.

As part of its review of the application, the NRC staff will prepare an environmental impact statement (EIS) under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8, the EIS will include analyses of potential impacts to historic properties, and will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants.

If approved, the ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

Accession No. ML040090125

T. Wagner 2

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for this ESP review is the area at the power plant site and its immediate environs which may be impacted by land-disturbing activities associated with the construction and operation of the new unit(s). The power plant site is located in Claiborne County, Mississippi.

We invite you and your staff to participate in the review of the Grand Gulf ESP application. We will also be contacting any Native American Tribes, including the Choctaw Nation of Oklahoma, the Choctaw of Mississippi, and the Tunika Biloxi Indian Tribe of Louisiana that may have a potential interest in the proposed undertaking, affording them the opportunity to participate in this process and identify issues of concern to them. These tribes have been identified by records research with the Bureau of Indian Affairs, State and local governments, tribal organizations, and at a meeting the NRC had with Department of Archives and History staff on July 30, 2003.

On January 21, 2004, the NRC will conduct a public environmental scoping meeting from 7:00 p.m. until 10:00 p.m. at the Port Gibson City Hall, located at 1005 College Street, Port Gibson, Mississippi. You and your staff are invited to attend. Your office will receive a copy of the draft EIS along with a request for comments after it is issued. The draft EIS will include identification of historic properties, assessment of impacts, and our preliminary determination. The anticipated publication date for the draft EIS is February 2005. If you have any questions or require additional information, please contact Ms. Cristina Guerrero at 301-415-2981 or CXG3@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-009

Accession No. ML040090141

January 8, 2004

Mr. Russ Watson
Acting Field Office Supervisor
U.S. Fish and Wildlife Service
Louisiana Ecological Services Office
646 Cajundome Blvd.
Lafayette, LA 70506

SUBJECT: APPLICATION FOR AN EARLY SITE PERMIT FOR THE GRAND GULF SITE

Dear Mr. Watson:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the potential future construction of one or more new nuclear power plants. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). The impact analysis in the EIS includes the potential impacts of the construction and operation of a new nuclear power plant at the preferred or alternate sites, including the potential impacts to fish and wildlife and threatened and endangered species.

SERI's preferred location for the proposed new power plant(s) is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Claiborne County, Mississippi. Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; Fitzpatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The application for an ESP was submitted by SERI on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR 52). If approved, the ESP will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. The ESP would not authorize the applicant to begin construction of the unit(s). However, in its review the NRC staff will evaluate the environmental impacts of construction and operation and will also consider alternatives, including alternative sites.

To support the EIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests a list of endangered, threatened, candidate, or proposed species and critical habitat that are known to occur or could potentially occur in West Feliciana County, Louisiana. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act of 1934.

Accession No. ML040090141

R. Watson 2

If you have any questions concerning the ESP application, or other aspects of this project, please contact Ms. Cristina Guerrero, at (301) 415-2981 or by e-mail at CXG3@nrc.gov.

Sincerely,

/RA/

Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 52-009

Accession No. ML040090292

January 8, 2004

The Honorable Phillip Martin, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6010 - Choctaw Branch
Choctaw, MS 39350

SUBJECT: EARLY SITE PERMIT (ESP) REVIEW FOR THE GRAND GULF SITE

Dear Chief Martin:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application for an ESP to set aside a site for the potential future construction of one or more new nuclear power plants. The application was submitted by System Energy Resources, Inc. (SERI), on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR Part 52). If built, the new unit(s) would be co-located with the existing Grand Gulf Nuclear Power Station (GGNS) site near the town of Port Gibson in Claiborne County, Mississippi.

As part of its review of the application, the NRC staff will prepare an environmental impact statement (EIS) under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). The NRC environmental review process includes an opportunity for public participation in the environmental review. The Grand Gulf ESP site is located on land that may be of interest to the Mississippi Band of Choctaw Indians. We want to ensure that you are aware of our efforts and, pursuant to our regulations at 10 CFR 51.28(b), the NRC invites the Mississippi Band of Choctaw Indians to provide input to the scoping process relating to the NRC's environmental review of the application. The following is a description of the application and the environmental review process.

The EIS will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. In addition, the staff will also consider alternatives to the proposed action, including alternative sites. The EIS will contain the results of the review of the environmental impacts on the area surrounding the Grand Gulf ESP site that are related to terrestrial ecology, aquatic ecology, hydrology, socioeconomic issues, and historic properties (among others), and will contain a recommendation regarding the environmental acceptability of granting an ESP. If approved, the ESP would not authorize the applicant to begin construction of the unit(s).

As part of this review, and in accordance with 36 CFR 800.8, the EIS will include analyses of potential impacts to historic properties. Accordingly, pursuant to 10 CFR 51.28 and 36 CFR 800.2(c), the NRC wishes to ensure that Indian tribes that might have an interest in any potential historic properties in the area of potential effect (APE) are afforded the opportunity to identify their concerns, provide advice on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, and, if necessary, participate in the resolution of any adverse effects to such properties.

Accession No. ML040090292

The Honorable P. Martin

In the context of the National Historic Preservation Act of 1966, as amended, the APE for this ESP review is the area at the power plant site and its immediate environs that may be impacted by land-disturbing activities associated with the construction and operation of the new unit(s). GGNS is located in Claiborne County, Mississippi. The application is available through the web-based version of the NRC's Agencywide Documents Access and Management System (ADAMS) which can be found at http://www.nrc.gov/reading-rm/adams.html. The application is listed under accession number ML032960315.

On January 21, 2004, the NRC will conduct a public environmental scoping meeting from 7:00 p.m. until 10:00 p.m. at the Port Gibson City Hall, located at 1005 College Street, Port Gibson, Mississippi. Representatives of your tribe are invited to attend. The meeting will be preceded by a one-hour open house during which members of the public may meet and talk with NRC staff members on an informal basis.

Please submit any written comments your tribe may have to offer on the scope of the environmental review by February 12, 2004. Comments should be submitted either by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001, or by e-mail to *GrandGulfEIS@nrc.gov.*

At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and will send a copy to you. In addition, after it is issued, your office will receive a copy of the draft EIS along with a request for comments. The anticipated publication date for the draft EIS is February 2005. If you have any questions or require additional information, please contact Ms. Cristina Guerrero at 301-415-2981 or *GrandGulfEIS@nrc.gov.*

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-009

Accession No. ML040090309

January 8, 2004

The Honorable Gregory E. Pyle, Chief
Choctaw Nation of Oklahoma
P. O. Drawer 1210
Durant, OK 74702-1210

SUBJECT: EARLY SITE PERMIT (ESP) REVIEW FOR THE GRAND GULF SITE

Dear Chief Pyle:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application for an ESP to set aside a site for the potential future construction of one or more new nuclear power plants. The application was submitted by System Energy Resources, Inc. (SERI), on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR Part 52). If built, the new unit(s) would be co-located with the existing Grand Gulf Nuclear Power Station (GGNS) site near the town of Port Gibson in Claiborne County, Mississippi.

As part of its review of the application, the NRC staff will prepare an environmental impact statement (EIS) under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). The NRC environmental review process includes an opportunity for public participation in the environmental review. The Grand Gulf ESP site is located on land that may be of interest to the Choctaw Nation of Oklahoma. We want to ensure that you are aware of our efforts and, pursuant to our regulations at 10 CFR 51.28(b), the NRC invites the Choctaw Nation of Oklahoma to provide input to the scoping process relating to the NRC's environmental review of the application. The following is a description of the application and the environmental review process.

The EIS will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. In addition, the staff will also consider alternatives to the proposed action, including alternative sites. The EIS will contain the results of the review of the environmental impacts on the area surrounding the Grand Gulf ESP site that are related to terrestrial ecology, aquatic ecology, hydrology, socioeconomic issues, and historic properties (among others), and will contain a recommendation regarding the environmental acceptability of granting an ESP. If approved, the ESP would not authorize the applicant to begin construction of the unit(s).

As part of this review, and in accordance with 36 CFR 800.8, the EIS will include analyses of potential impacts to historic properties. Accordingly, pursuant to 10 CFR 51.28 and 36 CFR 800.2(c), the NRC wishes to ensure that Indian tribes that might have an interest in any potential historic properties in the area of potential effect (APE) are afforded the opportunity to identify their concerns, provide advice on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, and, if necessary, participate in the resolution of any adverse effects to such properties.

Accession No. ML040090309

The Honorable G. Pyle -2-

In the context of the National Historic Preservation Act of 1966, as amended, the APE for this ESP review is the area at the power plant site and its immediate environs that may be impacted by land-disturbing activities associated with the construction and operation of the new unit(s). GGNS is located in Claiborne County, Mississippi. The application is available through the web-based version of the NRC's Agencywide Documents Access and Management System (ADAMS) which can be found at http://www.nrc.gov/reading-rm/adams.html. The application is listed under accession number ML032960315.

On January 21, 2004, the NRC will conduct a public environmental scoping meeting from 7:00 p.m. until 10:00 p.m. at the Port Gibson City Hall, located at 1005 College Street, Port Gibson, Mississippi. Representatives of your tribe are invited to attend. The meeting will be preceded by a one-hour open house during which members of the public may meet and talk with NRC staff members on an informal basis.

Please submit any written comments your tribe may have to offer on the scope of the environmental review by February 12, 2004. Comments should be submitted either by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6 D59, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001, or by e-mail to *GrandGulfEIS@nrc.gov.*

At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and will send a copy to you. In addition, after it is issued, your office will receive a copy of the draft EIS along with a request for comments. The anticipated publication date for the draft EIS is February 2005. If you have any questions or require additional information, please contact Ms. Cristina Guerrero at 301-415-2981 or *GrandGulfEIS@nrc.gov.*

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-009

Accession No. ML040090330

January 8, 2004

Earl J. Barbry Jr., State Historic Preservation Officer
Tunika Biloxi Indian Tribe of Louisiana
PO 1589
Marksville, LA 71351

SUBJECT: EARLY SITE PERMIT (ESP) REVIEW FOR THE GRAND GULF SITE

Dear Mr. Barbry:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application for an ESP to set aside a site for the potential future construction of one or more new nuclear power plants. The application was submitted by System Energy Resources, Inc. (SERI), on October 16, 2003, pursuant to NRC requirements at Title 10 of the *Code of Federal Regulations* Part 52 (10 CFR Part 52). If built, the new unit(s) would be co-located with the existing Grand Gulf Nuclear Power Station (GGNS) site near the town of Port Gibson in Claiborne County, Mississippi.

As part of its review of the application, the NRC staff will prepare an environmental impact statement (EIS) under the provisions of 10 CFR Part 51, the NRC rules that implement the National Environmental Policy Act of 1969 (NEPA). The NRC environmental review process includes an opportunity for public participation in the environmental review. The Grand Gulf ESP site is located on land that may be of interest to the Tunika Biloxi Indian Tribe of Louisiana. We want to ensure that you are aware of our efforts and, pursuant to our regulations at 10 CFR 51.28(b), the NRC invites the Tunika Biloxi Indian Tribe of Louisiana to provide input to the scoping process relating to the NRC's environmental review of the application. The following is a description of the application and the environmental review process.

The EIS will document the NRC staff's determination regarding the suitability of the proposed site for the construction and operation of one or more new nuclear plants. In addition, the staff will also consider alternatives to the proposed action, including alternative sites. The EIS will contain the results of the review of the environmental impacts on the area surrounding the Grand Gulf ESP site that are related to terrestrial ecology, aquatic ecology, hydrology, socioeconomic issues, and historic properties (among others), and will contain a recommendation regarding the environmental acceptability of granting an ESP. If approved, the ESP would not authorize the applicant to begin construction of the unit(s).

As part of this review, and in accordance with 36 CFR 800.8, the EIS will include analyses of potential impacts to historic properties. Accordingly, pursuant to 10 CFR 51.28 and 36 CFR 800.2(c), the NRC wishes to ensure that Indian tribes that might have an interest in any potential historic properties in the area of potential effect (APE) are afforded the opportunity to identify their concerns, provide advice on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, and, if necessary, participate in the resolution of any adverse effects to such properties.

Accession No. ML040090330

The Honorable E. J. Barbry

In the context of the National Historic Preservation Act of 1966, as amended, the APE for this ESP review is the area at the power plant site and its immediate environs that may be impacted by land-disturbing activities associated with the construction and operation of the new unit(s). GGNS is located in Claiborne County, Mississippi. The application is available through the web-based version of the NRC's Agencywide Documents Access and Management System (ADAMS) which can be found at http://www.nrc.gov/reading-rm/adams.html. The application is listed under accession number ML032960315.

On January 21, 2004, the NRC will conduct a public environmental scoping meeting from 7:00 p.m. until 10:00 p.m. at the Port Gibson City Hall, located at 1005 College Street, Port Gibson, Mississippi. Representatives of your tribe are invited to attend. The meeting will be preceded by a one-hour open house during which members of the public may meet and talk with NRC staff members on an informal basis.

Please submit any written comments your tribe may have to offer on the scope of the environmental review by February 12, 2004. Comments should be submitted either by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6 D59, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001, or by e-mail to *GrandGulfEIS@nrc.gov*.

At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and will send a copy to you. In addition, after it is issued, your office will receive a copy of the draft EIS along with a request for comments. The anticipated publication date for the draft EIS is February 2005. If you have any questions or require additional information, please contact Ms. Cristina Guerrero, at 301-415-2981 or *GrandGulfEIS@nrc.gov.*

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 52-009

Accession No. ML040260250

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mississippi Field Office
6578 Dogwood View Parkway, Suite A
Jackson, Mississippi 39213

January 21, 2004

Proj-720
52-009

Mr. Pao-Tsin Kuo
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Kuo:

The U.S. Fish and Wildlife Service (Service) received your letter dated January 8, 2004, regarding the preparation of an Environmental Impact Statement (EIS) for the construction of one or more new nuclear power plants in Claiborne County, Mississippi. Our comments are submitted in accordance with the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

The following listed species could be found in the proposed project area:

The endangered interior least tern (*Sterna antillarum*) migrates up the Mississippi River and lays its eggs directly on the sandbars associated with the river. Hundreds of these birds may nest together to form a colony.

The endangered pallid sturgeon (*Scaphirhynchus albus*) is found in the lower Mississippi River, although it is rare throughout its range. These fish require large, turbid, free-flowing riverine habitats, and feed mainly on other fish. They are usually found near the bottom of streams or lakes in sand flats or gravel bars. Little information is known on spawning or migration habits of these fish, although spawning likely occurs in the spring and summer months.

The breeding/spawning season for terns and sturgeons is approximately May through July. Avoidance of these areas during the above time would prevent adverse impacts to either species. Both species can change nesting/spawning areas from year to year, so an onsite survey for both species just before start of construction is recommended.

The threatened Bayou darter (*Etheostoma rubrum*) is found only in Bayou Pierre and its tributaries: White Oak Creek, Foster Creek, and Turkey Creek. The darter prefers stable gravel riffles or sandstone exposures with large sized gravel or rock. Habitat loss or degradation has been a major contributor to the reduction in bayou darter numbers.

Add: Laura Dudes
Steve Koenick
Andy Kugler
Tom Kenyon
Jim Wilson

D069

Accession No. ML040260250

The threatened bald eagle (*Haliaeetus leucocephalus*) is the only species of "sea eagle" regularly occurring on the North American continent. The bald eagle is predominantly a winter migrant in the southeast; however, increasing occurrences of nesting have been observed. The bald eagle nests in the transitional area between forest and water. They construct their nests in dominant living pines or bald cypress trees. Eagles often use alternate nests in different years with nesting activity occurring between September and January of each year. Young are usually fledged by midsummer.

The federally listed threatened Louisiana black bear (*Ursus a. luteolus*) occurs primarily in bottomland hardwood and floodplain forests along the Mississippi River and the southern part of the state. Although the bear is capable of surviving under a range of habitat types, some necessary habitat requirements include hard mast, soft mast, escape cover, denning sites, forested corridors, and limited human access. Forest management practices, agricultural, commercial and industrial development, and highways can cause adverse impacts to bear habitats by increasing human disturbance, fragmenting forests, and removing den trees.

All of the above listed species are very sensitive to human disturbance, and could be affected directly and also indirectly by the proposed projects. Therefore, before the use or transportation of any heavy construction equipment, or the removal of any vegetation within potential habitats, the Service recommends a qualified biologist conduct a visual survey for these species. Areas surveyed should also include ingress and egress areas, equipment storage areas, and staging areas.

The Service will provide you additional information and specific project recommendations during the EIS preparation process. If you have any additional questions, please feel free to contact Kathy Lunceford in this office, telephone: (601) 321-1132.

Sincerely,

Curtis B. James

Curtis B. James
Assistant Field Supervisor

Accession No. ML040370323

United States Department of the Interior

FISH AND WILDLIFE SERVICE
3817 Luker Road
Cortland, NY 13045

January 26, 2004

Proj 720
52-009

Mr. Pao-Tsin Kuo
Program Director
License Renewal & Environmental Impacts
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Attention: Ms. Cristina Guerrero

Dear Mr. Kuo:

This responds to your letter of January 6, 2004, requesting information on the presence of endangered or threatened species in the vicinity of the proposed Grand Gulf ESP alternate site, the Fitzpatrick Nuclear Power Plant, in the Town of Scriba, Oswego County, New York.

Except for occasional transient individuals, no Federally listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area. In addition, no habitat in the project impact area is currently designated or proposed "critical habitat" in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Therefore, no further Endangered Species Act coordination or consultation with the U.S. Fish and Wildlife Service (Service) is required. Should project plans change, or if additional information on listed or proposed species or critical habitat becomes available, this determination may be reconsidered. The most recent compilation of Federally listed and proposed endangered and threatened species in New York* is available for your information.

The above comments pertaining to endangered species under our jurisdiction are provided pursuant to the Endangered Species Act. This response does not preclude additional Service comments under other legislation.

For additional information on fish and wildlife resources or State-listed species, we suggest you contact the appropriate New York State Department of Environmental Conservation regional office(s),* and:

DO69

Accession No. ML040370323

New York State Department of Environmental Conservation
New York Natural Heritage Program Information Services
625 Broadway
Albany, NY 12233-4757
(518) 402-8935

Since wetlands may be present, you are advised that National Wetlands Inventory (NWI) maps may or may not be available for the project area. However, while the NWI maps are reasonably accurate, they should not be used in lieu of field surveys for determining the presence of wetlands or delineating wetland boundaries for Federal regulatory purposes. Copies of specific NWI maps can be obtained from:

Cornell Institute for Resource Information Systems
302 Rice Hall
Cornell University
Ithaca, NY 14853
(607) 255-4864

Work in certain waters of the United States, including wetlands, may require a permit from the U.S. Army Corps of Engineers (Corps). If a permit is required, in reviewing the application pursuant to the Fish and Wildlife Coordination Act, the Service may concur, with or without recommending additional permit conditions, or recommend denial of the permit depending upon potential adverse impacts on fish and wildlife resources associated with project construction or implementation. The need for a Corps permit may be determined by contacting the appropriate Corps office(s).*

If you require additional information or assistance please contact Michael Stoll at (607) 753-9334.

Sincerely,
Mark W. Clough
Acting For

David A. Stilwell
Field Supervisor

*Additional information referred to above may be found on our website at: http://nyfo.fws.gov/es/esdesc.htm.

cc: NYSDEC, Syracuse, NY (Environmental Permits)
NYSDEC, Albany, NY (Natural Heritage Program)
COE, Buffalo, NY

2

Accession No. ML040350504

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

Proj 720
52-009

JAN 28 2004

Pao-Tsin Kuo
Program Director, License Renewal and Environmental Impacts
Division of Regulatory Improvement Projects
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Docket No. 52-009

Dear Mr. Kuo,

This responds to your letter dated January 6, 2004, requesting information on the presence of any federally listed threatened or endangered species and/or designated critical habitat for listed species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries) in the vicinity of two sites for potential new nuclear power plants. The US Nuclear Regulatory Commission (NRC) is currently reviewing an application submitted by System Energy Resources Inc. (SERI) for an early site permit for the potential future construction of one or more new nuclear power plants. The preferred alternative for the location of the proposed new power plants is within the site boundaries of the existing Grand Gulf Nuclear Power Station (GGNS), site near the town of Port Gibson in Clairborne County, Mississippi. As part of the review of this application, the NRC is preparing an environmental impact statement (EIS). Three alternate sites will also be evaluated in the EIS. They are River Bend in West Feliciana County, Louisiana; FitzPatrick in Oswego County, New York; and Pilgrim in Plymouth County, Massachusetts.

The sites in Mississippi and Louisiana fall under the jurisdiction of NOAA Fisheries' Southeast Regional Office. It is our understanding that in a July 2002 letter, that office indicated that the Grand Gulf Site is within the historic range of the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*). Biological information on federally protected sea turtles, sturgeon, Gulf sturgeon, Gulf sturgeon critical habitat, and other listed and candidate species potentially present near the River Bend site can be found at the following website address: NOAA Fisheries Southeast Regional Office (http://caldera.sero.nmfs.gov/protect/protect.htm). The Southeast Regional Office can be contacted at: 9721 Executive Center Drive North, St. Petersburg, Florida 33702 or (727)570-5333.

No federally listed or proposed threatened or endangered species under the jurisdiction of

D069

Accession No. ML040350504

NOAA Fisheries are known to exist in the vicinity of the existing FitzPatrick Site. However, several threatened and endangered species are known to exist in Cape Cod Bay in the vicinity of the Pilgrim Site. Four species of federally threatened or endangered sea turtles and three species of endangered whales are found seasonally in Massachusetts waters. The sea turtles in northeastern nearshore waters are typically small juveniles with the most abundant being the federally threatened loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's ridley (*Lepidochelys kempi*). Loggerhead turtles have been found to be relatively abundant off the Northeast coast (from near Nova Scotia, Canada to Cape Hatteras, North Carolina). From November to March in 1985 through 1988, 130 cold-stunned turtles were collected along the Long Island shoreline, including 97 Kemp's ridleys. Loggerheads and Kemp's ridleys have been documented in waters as cold as 11°C, but generally migrate northward when water temperatures exceed 16°C. As such, these species usually arrive in Southern New England in June. Green sea turtles may occur sporadically in Massachusetts waters, but those instances would be rare. Federally endangered leatherback sea turtles (*Dermochelys coriacea*) are located in near shore New England waters during the warmer months as well.

Federally endangered North Atlantic right whales (*Eubalaena glacialis*), humpback whales (*Megaptera novaeangliae*), and fin whales (*Balaenoptera physalus*) may all also be found seasonally in Massachusetts waters. North Atlantic right whales have been documented in the nearshore waters of New England from January through September. Humpback whales feed during the spring, summer, and fall over a range that encompasses the eastern coast of the United States. Fin whales are common in waters of the United States Exclusive Economic Zone, principally offshore from Cape Hatteras northward.

While not protected under the Endangered Species Act (ESA) of 1973, as amended, minke whales (*Balaenoptera acutorostrata*), gray seals (*Halichoerus grypus*), harbor seals (*Phoca vitulina*), harbor porpoises (*Phocoena phocoena*), and white-sided dolphins (*Lagenorhynchus acutus*) are common residents of Massachusetts waters and may be present in the vicinity of the Plymouth Site. All marine mammals receive protection under the Marine Mammal Protection Act of 1972 (MMPA).

Section 7(a)(2) of the Endangered Species Act (ESA) states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Because listed species may be present in the vicinity of several of the proposed sites and may be affected by the construction and operation of a new nuclear power project, an action at these sites would have to undergo Section 7 consultation. The federal action agency, in this case the NRC, would be responsible for initiating Section 7 consultation. If one of the sites where listed species are present is chosen, please submit a description of the project along with an assessment of the projects impacts on listed species to the appropriate NOAA Fisheries Regional Office. After reviewing this information, NOAA Fisheries will then be able to conduct a consultation under Section 7 of the ESA. If you have any questions or concerns about these comments or about

Accession No. ML040350504

the consultation process in general, please contact Julie Crocker of my staff at (978) 281-9328 ext. 6530 (Northeast Region) or Dr. Stephania Bolden at (727)570-5312 (Southeast Region).

Sincerely,

Mary Colligan

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

Cc: Bolden, F/SER3

File Code: Sec 7 NRC Massachusetts

Accession No. ML040500681

United States Department of the Interior

RECEIVED
2004 FEB 18 AM 9: 21
Rules and Directives Branch USNRC

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
February 5, 2004

Mr. Pao-Tsin Kuo
U.S. Nuclear Regulatory Commission
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
Washington, District of Columbia 20555-0001

12/31/03
68 FR 75656
(1)

Dear Mr. Kou:

Please reference your January 8, 2004, letter regarding the application by System Energy Resources, Incorporated for an early site permit for the potential future construction of a nuclear power plant in one or more of the following locations: Port Gibson, Claiborne County, Mississippi; River Bend, West Feliciana Parish, Louisiana; Fitzpatrick, Oswego County, New York; and Pilgrim, Plymouth County, Massachusetts. Your letter requests information regarding threatened and endangered species, as well as environmentally sensitive areas, which may occur within West Feliciana Parish, Louisiana. The requested information will assist in the preparation of the environmental impact statement (EIS) by the U.S. Nuclear Regulatory Commission (NRC). As such, this letter also serves as our input to the Notice of Intent published in the December 31, 2003, Federal Register. Various U.S. Fish and Wildlife Service offices have reviewed the information you provided; pertaining solely to the River Bend Alternative in West Feliciana Parish, Louisiana, the Lafayette Field Office offers the following comments in accordance with the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The threatened Louisiana black bear (*Ursus americanus luteolus*) is primarily associated with forested wetlands; however, it utilizes a variety of habitat types, including marsh, spoil banks, and upland forests. Within forested wetlands, black bear habitat requirements include soft and hard mast for food, thick vegetation for escape cover, vegetated corridors for dispersal, large trees for den sites, and isolated areas for refuge from human disturbance. Remaining Louisiana black bear populations occur in the Tensas River Basin, the Upper Atchafalaya River Basin, and coastal St. Mary and Iberia Parishes. The primary threats to the species are continued loss of bottomland hardwoods, fragmentation of remaining forested tracts, and human-caused mortality (e.g., illegal killing and accidental collisions with motor vehicles).

Louisiana black bears, particularly pregnant females, normally den from December through April. In order to avoid disturbance of denning bears and possible abandonment of cubs, the Service recommends that any work in the project area be prohibited during the denning season.

Template = ADM-013

E-RIDS = ADM-03
Add = James Wilson (JHW1)

Accession No. ML040500681

To further protect denning bears, the Service, through the final rule, has extended legal protection to candidate or actual den trees. These are defined in the final rule as bald cypress (*Taxodium distichum*) and tupelo gum (*Nyssa* sp.) with visible cavities, having a diameter at breast height of 36 inches or greater, and occurring in or along rivers, lakes, streams, bayous, sloughs, or other water bodies. If construction is to be performed during the denning season or if bald cypress or tupelo gum with diameters at breast height of 36 inches or greater will be removed or destroyed, further consultation with this office will be necessary.

The pallid sturgeon (*Scaphirhynchus albus*) is an endangered fish found in both the Mississippi and Atchafalaya Rivers (with known concentrations in the vicinity of the Old River Control Structure Complex); it is possibly found in the Red River as well. The pallid sturgeon is adapted to large, free-flowing, turbid rivers with a diverse assemblage of physical habitats that are in a constant state of change. Detailed habitat requirements of this fish are not known, but it is believed to spawn in Louisiana. Habitat loss through river channelization and dams has adversely affected this species throughout its range.

As you may be aware, activities that involve wetlands are regulated by the U.S. Army Corps of Engineers (Corps). We, therefore, recommend that you contact the Corps to determine their interest in the proposed projects.

We appreciate the opportunity to provide these initial comments in the planning stages of this proposed project, and look forward to reviewing the forthcoming draft EIS. If you need further assistance, please contact Angela Culpepper (337/291-3137) of this office.

Sincerely,

Russell C. Watson
Supervisor
Louisiana Field Office

cc: USFWS, Mississippi Ecological Services Office, Jackson, MS
USFWS, New York Ecological Services Office, Cortland, NY
USFWS, New England Ecological Services Office, Concord, NH
Chief, Rules and Directives Branch, USNRC, Washington, D.C.
Corps of Engineers, New Orleans, LA
LDWF, Natural Heritage Program, Baton Rouge, LA

Accession No. ML040650620

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

RE: Application for an early site permit (ESP)
Grand Gulf ESP Site

February 9, 2004

Proj 720
52-009

Pao-Tsin Kuo
Office of Nuclear Reactor Regulations
United States Nuclear Regulatory Commission
Washington D.C. 20555-0001

Dear Mr. Kuo:

I have reviewed your request for information on endangered and threatened species and their habitats for the above-referenced project. My comments are provided in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543). This letter addresses only the compliance with the Section 7 of the ESA and not the Fish and Wildlife Coordination Act of 1934.

This office has reviewed the proposed alternative site in Plymouth County, Massachusetts. The following is a list of federally-threatened or endangered species found in the county: northern red-bellied cooter (*Chrysemys rubriventris bangsi*), roseate tern (*Sterna dougallii dougallii*), piping plover (*Charadrius melodus*), and bald eagle (*Haliaeetus leucocephalus*). In order to comply with the Massachusetts Endangered Species Act and the Massachusetts Wetlands Protection Act (310 CMR 10), we suggest that you consult with the Massachusetts Natural Heritage and Endangered Species Program, Route 135, Westborough, MA 01581, telephone (508) 792-7270, extension 200, for information on state-listed species that are present.

Thank you for your cooperation and please contact me at 603-223-2541, extension 23, if we can be of further assistance.

Sincerely yours,

Michael J. Amaral

Michael J. Amaral
Endangered Species Specialist
New England Field Office

D069

Accession No. ML041310449

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mississippi Field Office
6578 Dogwood View Parkway, Suite A
Jackson, Mississippi 39213
April 14, 2004

52-009

Dr. Michael T. Masnik
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Mail Stop: O11F1
Washington, D.C. 20555-0001

Dear Dr. Masnik:

In a letter dated January 21, 2004, the U.S. Fish and Wildlife Service (Service) provided your agency with information on federally listed threatened and endangered species as it pertained to the preparation of an Environmental Impact Statement (EIS) for the construction of one or more new nuclear power plants in Claiborne County, Mississippi. Since that correspondence, another listed species, the endangered fat pocketbook mussel (*Potamilus capax*), has been identified in the project area. Our comments are provided in accordance with the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 et seq.).

In August 2003, Mississippi Museum of Natural Science biologists collected two fresh dead shells of the fat pocketbook in the Ben Lomond Dike Field near Vicksburg in the Mississippi River channel. The Service was notified of the new record and confirmed the identification of the specimens. Service biologists conducted cursory mussel surveys in the area and collected 14 fresh dead shells and one live fat pocketbook.

The fat pocketbook is a broad, rounded, inflated, and slightly angular near the hinge. The anterior margin is very narrow and rounded. The valves do not close perfectly on each other but gape at the posterior margin. The nacre is white or bluish white and often iridescent. The beaks are curved over the hinge ligament.

Fat pocketbooks occur primarily in sand and mud substrates, although the species has been found in fine gravel and hard clay occasionally. Water depth ranges from a few inches to several feet. The life cycle of fat pocketbooks is similar to that of other freshwater mussels, in which the glochidia (larvae) require a fish host to transform to the juvenile stage. Fat pocketbooks are long- term brooders, with females becoming gravid in the fall, retaining glochidia over winter, and releasing the progeny during spring and summer. The fish host for this species is primarily freshwater drum.

The historic range of the fat pocketbook included the upper and middle Mississippi, Ohio,

D069

Accession No. ML041310449

Wabash, White, St. Francis, Black, Spoon, Illinois, Des Moines, Iowa, Cumberland, and Neosho Rivers. However, during the past decade, three populations have been discovered in the lower Mississippi River in Mississippi, and the species was recently discovered surviving in the White River of Arkansas. The greatest impact on the fat pocketbook throughout its historic range has been from activities resulting in the loss of habitat and a reduction in water quality.

Although there is little data regarding the presence of the fat pocketbook mussel in the immediate project vicinity, potential project impacts to this species should be considered during the EIS preparation process. If you have any questions, please feel free to contact Kathy Lunceford in this office, telephone: (601) 321-1132.

Sincerely,

Curtis B. James

Curtis B. James
Assistant Field Supervisor

cc: Pacific Northwest National Laboratory, Richland, WA
Attn: Jim Becker, Amoret L. Bunn
Mississippi Museum of Natural Science, Jackson, MS
Attn: Tom Mann

Appendix G

Authorizations and Consultations

Appendix G

Authorizations and Consultations

Table G-1 contains a list of the environmental-related authorizations, permits, and certifications potentially required by Federal, State, local, and affected Native American tribal agencies related to the construction and operation of one or more new nuclear units at the proposed Grand Gulf early site permit site.

Table G-1. Federal, State, and Local Authorizations

Agency	Authority	Requirement	Activity Covered
U.S. Nuclear Regulatory Commission	10 CFR Part 50	Domestic Licensing of Production and Utilization Facilities	Construction permit for a new nuclear power plant
U.S. Nuclear Regulatory Commission	10 CFR Part 52	Combined License	Issuance of a combined license for new nuclear power plants
U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries	Endangered Species Act 16 USC 1536	Consultation	Consultation concerning potential impacts to threatened and endangered species
	16 USC 1539	Incidental Take Permit	Project related mortality and modification of critical habitat of Federal threatened and endangered species
U.S. Fish and Wildlife Service	Migratory Bird Treaty Act 16 USC 703	Consultation	Consultation concerning potential impacts to migratory birds
U.S. Army Corps of Engineers	Clean Water Act 33 USC 1251	Section 404 Permit	Aquatic resource alteration permit (wetland filling, stream alteration)
	33 CFR Part 209	Dredge and Fill Discharge Permit	Permit for discharge of dredged spoils
U.S. Coast Guard	14 USC 81, 83, 85, 633/49 USC 1655(b)		Navigation markers - authorization to protect river navigation from hazards connected with temporary construction activities in the river.
Federal Aviation Administration	Federal Aviation Act 14 CFR 77.13	Notice	Notice to the Federal Aviation Administration for structures over 200 ft in height (e.g., construction cranes and cooling towers)

Table G-1. (contd)

Agency	Authority	Requirement	Activity Covered
Mississippi Department of Environmental Quality	Regulation APC-S-2	Permit to Construct Permit to Operate	Permit for the construction and/or operation of air emissions equipment
Mississippi Department of Environmental Quality	Regulation APC-S-5	Permit	Mississippi regulations for the prevention of significant deterioration of air quality
Mississippi Department of Environmental Quality	Regulation APC-S-6	Permit	Air operating permit under Title V of the Federal Clean Air Act
Mississippi Department of Environmental Quality	Regulation HW-1	Permit	Hazardous waste management regulations
Mississippi Department of Environmental Quality	Regulation LW-1	Permit	Surface water and groundwater use and protection regulations
Mississippi Department of Environmental Quality	Regulation SW-2	Permit	Non-hazardous solid waste management regulations and criteria
Mississippi Department of Environmental Quality	Regulation UST-2	Permit	Underground storage tank regulations
Mississippi Department of Environmental Quality	Regulation WPC-1	National Pollutant Discharge Elimination System Storm Water Permit	Waste water regulations for National Pollutant Discharge Elimination System permits, water quality based effluent limitations, and water quality certification
Mississippi Department of Environmental Quality	Regulation WPC-2		Water quality criteria for intrastate, interstate, and coastal waters
Mississippi Department of Environmental Quality	Regulation WPC-3	Certification	Regulations for the certification of municipal and domestic waste water facility operators
Mississippi Department of Wildlife, Fisheries, and Parks	Natural Heritage Program	Scientific Collection Permit	Ecological monitoring programs
Mississippi Public Service Commission	MS Code of 1972 SEC. 77-3-11	Certificate of Public Convenience and Necessity	Certificate that the present and future public convenience and necessity require or will require the operation of such equipment for facility
Louisiana Department of Wildlife and Fisheries	Natural Heritage Program	Scientific Collection Permit	Ecological monitoring programs

Appendix H

Data and Information to Support Specific Analyses

Appendix H

Data and Information to Support Specific Analyses

The data and information used by the U.S. Nuclear Regulatory Commission (NRC) staff to support specific analyses in the course of evaluating the proposed Grand Gulf early site permit (ESP) site and included in this appendix are:

- Section H.1 - Support Information for Projected Populations (see Chapter 2 for discussion)
- Section H.2 - Environmental Impacts of Transportation, which discusses the effects of both incident-free transportation, transportation accidents, and the environmental effects of radioactive waste shipments (see Section 6.2 for further discussion)
- Section H.3 - Support Information for Radiological Dose Assessment, which compares the System Energy Resources, Inc.'s assessment of the radiological impact of the proposed Grand Gulf ESP site with the NRC staff's independent assessment of the radiological impacts of normal operation for a new nuclear unit
- Section H.4 - References.

H.1 Support Information for Projected Populations (Chapter 2)

The projected resident population within 16 km (10 mi) of the proposed Grand Gulf ESP facility is shown in Table H-1 and discussed in Chapter 2. The projected resident population within 80 km (50 mi) of the proposed Grand Gulf ESP facility is shown in Table H-2 and also discussed in Chapter 2.

Table H-1. Projected Resident Population within 16 Kilometers (10 Miles) of the Proposed Grand Gulf Early Site Permit Facility

Sector/Year	0-2 km (0-1 mi)	2-3 km (1-2 mi)	3-5 km (2-3 mi)	5-6 km (3-4 mi)	6-8 km (4-5 mi)	8-16 km (5-10 mi)	Total
			North				
2002	0	3	0	0	0	10	13
2030	0	3	0	0	0	10	13
2040	0	3	0	0	0	10	13
2050	0	3	0	0	0	10	13
2060	0	3	0	0	0	10	13
2070	0	3	0	0	0	10	13

Table H-1. (contd)

Sector/Year	0-2 km (0-1 mi)	2-3 km (1-2 mi)	3-5 km (2-3 mi)	5-6 km (3-4 mi)	6-8 km (4-5 mi)	8-16 km (5-10 mi)	Total
N-NE							
2002	0	11	0	0	0	3	14
2030	0	11	0	0	0	3	14
2040	0	11	0	0	0	3	14
2050	0	11	0	0	0	3	14
2060	0	11	0	0	0	3	14
2070	0	11	0	0	0	3	14
NE							
2002	0	0	0	0	29	3	32
2030	0	0	0	0	31	3	34
2040	0	0	0	0	32	3	35
2050	0	0	0	0	33	3	36
2060	0	0	0	0	34	3	37
2070	0	0	0	0	34	4	38
E-NE							
2002	0	14	0	45	27	102	188
2030	0	15	0	48	29	110	202
2040	0	15	0	50	30	112	207
2050	0	16	0	51	30	115	212
2060	0	16	0	52	31	118	218
2070	0	17	0	53	32	121	223
East							
2002	0	17	0	84	68	173	342
2030	0	18	0	90	73	186	368
2040	0	19	0	93	75	191	377
2050	0	19	0	95	77	195	386
2060	0	20	0	97	79	200	396
2070	0	20	0	100	81	205	406
E-SE							
2002	0	0	0	0	0	851	851
2030	0	0	0	0	0	915	915
2040	0	0	0	0	0	938	938
2050	0	0	0	0	0	961	961
2060	0	0	0	0	0	985	985
2070	0	0	0	0	0	1010	1010

Table H-1. (contd)

Sector/Year	0-2 km (0-1 mi)	2-3 km (1-2 mi)	3-5 km (2-3 mi)	5-6 km (3-4 mi)	6-8 km (4-5 mi)	8-16 km (5-10 mi)	Total
SE							
2002	0	0	10	0	212	3312	3534
2030	0	0	11	0	228	3560	3799
2040	0	0	11	0	234	3649	3894
2050	0	0	11	0	239	3741	3991
2060	0	0	12	0	245	3834	4091
2070	0	0	12	0	252	3930	4193
S-SE							
2002	0	6	8	0	42	513	569
2030	0	6	9	0	45	551	612
2040	0	7	9	0	46	565	627
2050	0	7	9	0	47	579	643
2060	0	7	9	0	49	594	659
2070	0	7	9	0	50	609	675
South							
2002	0	0	4	0	0	96	100
2030	0	0	4	0	0	99	103
2040	0	0	4	0	0	100	104
2050	0	0	4	0	0	101	105
2060	0	0	4	0	0	102	106
2070	0	0	4	0	0	103	107
S-SW							
2002	0	0	0	0	0	1362	1362
2030	0	0	0	0	0	1464	1464
2040	0	0	0	0	0	1501	1501
2050	0	0	0	0	0	1538	1538
2060	0	0	0	0	0	1577	1577
2070	0	0	0	0	0	1616	1616
SW							
2002	0	0	0	0	0	6	6
2030	0	0	0	0	0	6	6
2040	0	0	0	0	0	7	7
2050	0	0	0	0	0	7	7
2060	0	0	0	0	0	7	7
2070	0	0	0	0	0	7	7

Table H-1. (contd)

Sector/Year	0-2 km (0-1 mi)	2-3 km (1-2 mi)	3-5 km (2-3 mi)	5-6 km (3-4 mi)	6-8 km (4-5 mi)	8-16 km (5-10 mi)	Total
			W-SW				
2002	0	0	0	0	0	98	98
2030	0	0	0	0	0	101	101
2040	0	0	0	0	0	102	102
2050	0	0	0	0	0	103	103
2060	0	0	0	0	0	104	104
2070	0	0	0	0	0	105	105
			West				
2002	0	0	0	0	0	101	101
2030	0	0	0	0	0	104	104
2040	0	0	0	0	0	105	105
2050	0	0	0	0	0	106	106
2060	0	0	0	0	0	107	107
2070	0	0	0	0	0	108	108
			W-NW				
2002	0	0	0	0	0	6	6
2030	0	0	0	0	0	6	6
2040	0	0	0	0	0	6	6
2050	0	0	0	0	0	6	6
2060	0	0	0	0	0	6	6
2070	0	0	0	0	0	6	6
			NW				
2002	0	0	0	0	0	35	35
2030	0	0	0	0	0	35	35
2040	0	0	0	0	0	35	35
2050	0	0	0	0	0	35	35
2060	0	0	0	0	0	35	35
2070	0	0	0	0	0	35	35
			N-NW				
2002	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0
2060	0	0	0	0	0	0	0
2070	0	0	0	0	0	0	0

Table H-1. (contd)

Sector/Year	0-2 km (0-1 mi)	2-3 km (1-2 mi)	3-5 km (2-3 mi)	5-6 km (3-4 mi)	6-8 km (4-5 mi)	8-16 km (5-10 mi)	Total
Totals							
2002	0	51	22	129	378	6671	7251
2030	0	54	23	139	406	7154	7776
2040	0	55	24	142	417	7327	7964
2050	0	56	25	146	427	7504	8157
2060	0	57	25	149	438	7686	8355
2070	0	58	26	153	449	7872	8557

Sources: SERI 2005a

Table H-2. Projected Resident Population within 80 Kilometers (50 Miles) of the Proposed Grand Gulf Early Site Permit Facility

Sector/Year	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Subtotal	0-16 km (0-10 mi)	Total
North							
2002	726	470	653	392	2,241	13	2,254
2030	770	498	692	416	2,375	13	2,388
2040	785	508	706	424	2,423	13	2,436
2050	801	518	720	432	2,471	13	2,484
2060	817	529	735	441	2,521	13	2,534
2070	833	539	749	450	2,571	13	2,584
N-NE							
2002	20,890	17,721	6,377	200	45,188	14	45,202
2030	22,770	19,316	6,951	218	49,255	14	49,269
2040	23,453	19,895	7,159	225	50,733	14	50,747
2050	24,157	20,492	7,374	231	52,255	14	52,269
2060	24,882	21,107	7,595	238	53,822	14	53,836
2070	25,628	21,740	7,823	245	55,437	14	55,451
NE							
2002	6000	6,132	2,005	680	14,817	32	14,849
2030	6450	6,592	2,155	731	15,928	34	15,962
2040	6611	6,757	2,209	749	16,326	35	16,361
2050	6777	6,926	2,264	768	16,735	36	16,771
2060	6946	7,099	2,321	787	17,153	37	17,190
2070	7120	7,276	2,379	807	17,582	38	17,620

Table H-2. (contd)

Sector/Year	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Subtotal	0-16 km (0-10 mi)	Total
E-NE							
2002	836	2,213	27,800	48,984	79,833	188	80,021
2030	901	2,386	29,968	52,805	86,060	202	86,262
2040	925	2,448	30,748	54,178	88,298	207	88,505
2050	949	2,511	31,547	55,586	90,593	212	90,805
2060	973	2,577	32,367	57,032	92,949	218	93,167
2070	999	2,644	33,209	58,514	95,365	223	95,588
East							
2002	1,238	1,456	10,900	8,039	21,633	342	21,975
2030	1,355	1,594	11,930	8,799	23,677	368	24,045
2040	1,398	1,644	12,306	9,076	24,423	377	24,800
2050	1,442	1,696	12,693	9,362	25,192	386	25,578
2060	1,487	1,749	13,093	9,657	25,986	396	26,382
2070	1,534	1,804	13,506	9,961	26,805	406	27,211
E-SE							
2002	995	1,160	7,000	8,020	17,175	851	18,026
2030	1,085	1,264	7,630	8,742	18,721	915	19,636
2040	1,117	1,302	7,859	9,004	19,282	938	20,220
2050	1,151	1,341	8,095	9,274	19,861	961	20,822
2060	1,185	1,382	8,338	9,552	20,457	985	21,442
2070	1,221	1,423	8,588	9,839	21,070	1,010	22,080
SE							
2002	1,200	1,613	4,151	18,987	25,951	3,534	29,485
2030	1,308	1,758	4,525	20,696	28,287	3,799	32,086
2040	1,347	1,811	4,660	21,317	29,135	3,894	33,029
2050	1,388	1,865	4,800	21,956	30,009	3,991	34,000
2060	1,429	1,921	4,944	22,615	30,910	4,091	35,001
2070	1,472	1,979	5,092	23,293	31,837	4,193	36,030
S-SE							
2002	700	483	1,764	4,226	7,173	569	7,742
2030	753	519	1,896	4,543	7,711	612	8,323
2040	771	532	1,944	4,657	7,904	627	8,531
2050	791	546	1,992	4,773	8,101	643	8,744
2060	810	559	2,042	4,892	8,304	659	8,963
2070	831	573	2,093	5,015	8,511	675	9,186

Table H-2. (contd)

Sector/Year	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Subtotal	0-16 km (0-10 mi)	Total
South							
2002	3,900	2,222	1,242	1,087	8,451	100	8,551
2030	4,017	2,289	1,279	1,120	8,705	103	8,808
2040	4,057	2,312	1,292	1,131	8,792	104	8,896
2050	4,098	2,335	1,305	1,142	8,879	105	8,984
2060	4,139	2,358	1,318	1,154	8,968	106	9,074
2070	4,180	2,382	1,331	1,165	9,058	107	9,165
S-SW							
2002	1,069	8,026	16,095	10,600	35,790	1,362	37,152
2030	1,101	8,267	16,578	10,918	36,864	1,464	38,328
2040	1,112	8,349	16,744	11,027	37,232	1,501	38,733
2050	1,123	8,433	16,911	11,137	37,605	1,538	39,143
2060	1,134	8,517	17,080	11,249	37,981	1,577	39,558
2070	1,146	8,602	17,251	11,361	38,361	1,616	39,977
SW							
2002	500	1,712	5,700	8,034	15,946	6	15,952
2030	530	1,815	6,042	8,516	16,903	6	16,909
2040	541	1,851	6,163	8,686	17,241	7	17,248
2050	551	1,888	6,286	8,860	17,586	7	17,593
2060	562	1,926	6,412	9,037	17,937	7	17,944
2070	574	1,964	6,540	9,218	18,296	7	18,303
W-SW							
2002	1,230	1,400	2,122	1,196	5,948	98	6,046
2030	1,333	1,518	2,300	1,296	6,448	101	6,549
2040	1,371	1,560	2,365	1,333	6,628	102	6,730
2050	1,409	1,604	2,431	1,370	6,814	103	6,917
2060	1,448	1,649	2,499	1,408	7,005	104	7,109
2070	1,489	1,695	2,569	1,448	7,201	105	7,306
West							
2002	300	698	3,463	3,098	7,559	101	7,660
2030	323	752	3,733	3,340	8,149	104	8,253
2040	332	772	3,830	3,426	8,360	105	8,465
2050	340	792	3,930	3,516	8,578	106	8,684
2060	349	813	4,032	3,607	8,801	107	8,908
2070	358	834	4,137	3,701	9,030	108	9,138

Table H-2. (contd)

Sector/Year	16-32 km (10-20 mi)	32-48 km (20-30 mi)	48-64 km (30-40 mi)	64-80 km (40-50 mi)	Subtotal	0-16 km (0-10 mi)	Total
			W-NW				
2002	2,012	1,700	4,586	5,946	14,244	6	14,250
2030	2,169	1,833	4,944	6,410	15,355	6	15,361
2040	2,225	1,880	5,072	6,576	15,754	6	15,760
2050	2,283	1,929	5,204	6,747	16,164	6	16,170
2060	2,343	1,979	5,339	6,923	16,584	6	16,590
2070	2,403	2,031	5,478	7,103	17,015	6	17,021
			NW				
2002	104	240	1,418	7,000	8,762	35	8,797
2030	113	262	1,546	7,630	9,551	35	9,586
2040	117	269	1,592	7,859	9,837	35	9,872
2050	120	278	1,640	8,095	10,132	35	10,167
2060	124	286	1,689	8,338	10,436	35	10,471
2070	128	294	1,740	8,588	10,749	35	10,784
			N-NW				
2002	700	3,338	8,300	2,069	14,407	0	14,407
2030	768	3,663	9,109	2,271	15,812	0	15,812
2040	793	3,783	9,405	2,345	16,326	0	16,326
2050	819	3,905	9,711	2,421	16,856	0	16,856
2060	846	4,032	10,027	2,499	17,404	0	17,404
2070	873	4,163	10,352	2,581	17,970	0	17,970
			Totals				
2002	42,400	50,584	103,576	128,558	325,118	7,251	332,369
2030	45,746	54,325	111,279	138,449	349,799	7,776	357,575
2040	46,955	55,673	114,054	142,012	358,694	7,964	366,658
2050	48,197	57,059	116,904	145,671	367,831	8,157	375,988
2060	49,475	58,482	119,831	149,429	377,217	8,355	385,572
2070	50,788	59,944	122,838	153,288	386,858	8,557	395,415

Sources: SERI 2005a

H.2 Environmental Impacts of Transportation

Section H.2 discusses the potential environmental impacts of transporting reactor fuel and radioactive waste to and from potential ESP sites including North Anna Power Station, Clinton Nuclear Power Station, Grand Gulf Nuclear Station, and their associated alternative sites. Section H.2.1 briefly discusses the effects of transporting unirradiated fuel to ESP sites, and Section H.2.2 discusses the effects of transporting spent fuel from ESP sites to a spent fuel disposal facility. Section H.2.3 discusses the environmental effects of radioactive waste shipments.

H.2.1 Unirradiated Fuel Shipping

This section addresses the number and characteristics of shipments of unirradiated fuel to ESP sites relative to the conditions in 10 CFR 51.52. Comparisons are also made against Table S–4 in 10 CFR 51.52(c) and WASH-1238 (AEC 1972), which provided the data that supports Table S–4. Section H.2.1.1 presents the basic unirradiated fuel shipping requirements for each advanced reactor design. These data were extracted from INEEL (2003). Section H.2.1.2 presents the comparisons to 10 CFR 51.52 conditions.

H.2.1.1 Advanced Reactor Unirradiated Fuel Shipping Data

In WASH-1238 (AEC 1972), a reference boiling water reactor (BWR) and pressurized water reactor (PWR) were used to formulate the basic numbers of unirradiated fuel shipments required for initial core loading and refueling. Both reference reactor types had a net electrical output of 1100 MW(e). The reference BWR assumed an initial core loading of 150 metric tons of uranium (MTU), and the reference PWR assumed a 100 MTU initial loading. Both reactor types resulted in 18 truck shipments of unirradiated fuel per reactor for initial core loading. Annual reload quantities were assumed to be 30 MTU/yr for both reactor types, which resulted in an additional six truck shipments per year per reactor. In total, about 252 truck shipments of unirradiated fuel would be required over a 40-year reactor life, including the initial core and 39 years of reloads, for both reactor types.

The initial fuel loading and annual reload quantities for the Advanced Boiling Water Reactor (ABWR), a 1500-MW(e) reactor, and the Economic Simplified Boiling Water Reactor (ESBWR) are approximately the same: 156.96 MTU per reactor initial core loading and 32.76 MTU/yr per reactor reload quantities (INEEL 2003). This equates to about 872 unirradiated fuel assemblies in the initial core and 213 assemblies per year for refueling. Truck shipment capacities were stated in INEEL (2003) to be 28 to 30 unirradiated fuel assemblies per truck shipment. Assuming 30 fuel assemblies per truck shipment, approximately 30 shipments of unirradiated fuel would be required to load the initial core and 6.1 truck shipments per year would be needed for refueling. If 28 fuel assemblies per truck shipment are used, the initial core load would require about 32 shipments of unirradiated fuel and annual refueling would require about 6.5 truck shipments per year.

The surrogate AP1000 is an 1150-MW(e) advanced PWR. The initial core load was estimated to be 84.5 MTU per reactor, and the annual reload requirement was estimated to be 24.4 MTU/yr per reactor. The data in INEEL (2003) also indicated that the average uranium mass in an unirradiated surrogate AP1000 fuel assembly would be 0.583 MTU and that 12 fuel assemblies per truck shipment would be transported. Therefore, about 14 truck shipments would be needed to supply the initial core and about 3.8 truck shipments per year would be needed to support refueling. For a site with two reactors, these estimates would be doubled.

The ACR-700 is an Advanced CANDU (CANada Deuterium Uranium) Reactor assumed to generate 731 MW(e). It was stated in INEEL (2003) that the initial core load for the ACR-700 is 61.3 MTU per reactor, and the annual refueling requirement is 33.1 MTU/yr per reactor. Each fuel assembly contains 18 kg of uranium (INEEL 2003). This corresponds to 3406 fuel assemblies in the initial core loading and 1839 fuel assemblies per year for refueling. The range of truck shipment capacities given by INEEL (2003) was 180 to 240 fuel assemblies per truck shipment. This equates to 15 to 19 truck shipments needed to supply the initial core load and from 7.7 to 10.2 annual refueling shipments. For a site with two reactors, these estimates would be doubled.

The International Reactor Innovative and Secure (IRIS) design is a 335-MW(e) advanced PWR. It requires an initial core load of 48.67 MTU or 89 fuel assemblies per unit (546.9 kg of uranium per fuel assembly) (INEEL 2003). For refueling, the IRIS reactor was assumed to require an additional 6.26 MTU/yr of unirradiated fuel per reactor or about 40 unirradiated fuel assemblies every 3.5 years. INEEL (2003) indicates that a “typical” site may contain three reactors. Assuming each truck shipment carries eight fuel assemblies, the initial core load would require 34 truck shipments per three-reactor site, and annual refueling would require an additional 4.3 truck shipments per year per three-reactor site.

The Gas Turbine–Modular Helium Reactor (GT-MHR) is a gas-cooled reactor that uses a substantially different fuel design than current and advanced LWRs. The reactor’s thermal power level is rated at 600 MW(t) per reactor, and the electric generation capacity is rated at 285 MW(e) per reactor. A standard GT-MHR site is assumed to be composed of four reactors. INEEL (2003) states that the initial core load for a single reactor would be about 1020 fuel assemblies. Annual average reload requirements would be 510 fuel assemblies per reactor. INEEL (2003) also indicates that each truck shipment could carry 80 fuel assemblies, so for all four reactors, about 51 truck shipments would be required to transport the initial core load and about 20 truck shipments per year would be required for the annual reload requirements.

The Pebble Bed Modular Reactor (PBMR) is a gas-cooled reactor that is rated at 400 MW(t) (165 MW(e)) per reactor. A typical PBMR site is assumed to consist of eight reactors. The PBMR uses a substantially different fuel design than a typical LWR. INEEL (2003) states that each reactor requires 260,000 fuel spheres for its initial core load; 120,000 fuel spheres per reactor are required for annual average reloads. A total of 48,000 fuel spheres is assumed to be transported in a typical truck shipment. As a result, it would take about 44 shipments of fuel spheres to transport the initial core load for all eight reactors and about 20 shipments per year to transport the annual reload quantity for all eight reactors.

To make comparisons to Table S–4, the environmental impacts were normalized to a reference reactor year. The reference reactor is an 1100 MW(e) reactor that has an 80 percent capacity factor, for a total electrical output of 880 MW(e) per year. The environmental impacts can be adjusted to calculate impacts per site by multiplying the normalized impacts by the ratio of the total electrical output for the advanced reactor sites to the electrical output of the reference reactor.

H.2.1.2 Analysis of the Environmental Impacts of Unirradiated Fuel Shipments

As required by 10 CFR 51.52, applicants for a construction permit are required to submit a statement that the reactor and the transportation of fuel and waste to and from the reactor meet all the conditions specified in 10 CFR 51.52(a) or 10 CFR 51.52(b). An ESP is a partial construction permit (10 CFR 52.21). The conditions specified in 10 CFR 51.52(a) that apply to unirradiated fuel include the following:

(1) The reactor core has a thermal loading less than 3800 MW. [51.52(a)(1)]

(2) The reactor fuel is in the form of sintered UO_2 pellets not exceeding 4 percent uranium-235 by weight, and the pellets are encapsulated in zircaloy rods. [51.52(a)(2)]

(3) Unirradiated fuel is shipped to the reactor by truck. [51.52(a)(5)]

(4) The environmental impacts of transportation of fuel and waste are as set forth in Summary Table S–4 in 10 CFR 51.52(c). [51.52(a)(6)]

If these conditions are not met, 10 CFR 51.52(b) requires the applicant to provide a full description and detailed analysis of the environmental impacts of transporting fuel and waste to and from the reactor, including values for the environmental impact under normal conditions of transport and the environmental risk from accidents in transport.

Unirradiated fuel shipment information for the advanced reactors is discussed below for each of these criteria.

Reactor Core Thermal Loading

The thermal output ratings of the seven advanced reactor types, as given in INEEL (2003), are as follows:

- ABWR – 4300 MW(t) (single reactor)
- ESBWR – 4000 MW(t) (single reactor)
- Surrogate AP1000 – 3400 MW(t) (single reactor)
- ACR-700 – 1982 MW(t) per reactor x two reactors per site = 3964 MW(t) per site
- IRIS – 1000 MW(t) per reactor x three reactors per site = 3000 MW(t) per site
- GT-MHR – 600 MW(t) per reactor x four reactors per site = 2400 MW(t) per site
- PBMR – 400 MW(t) per reactor x eight reactors per site = 3200 MW(t) per site.

As shown above, single-unit ABWR and ESBWR plants exceed the 3800-MW(t) condition in 10 CFR 51.52(a)(1). In addition, the twin-reactor ACR-700 site exceeds the core thermal power condition.

Reactor Fuel Form

All of the advanced LWRs (i.e., the ABWR, ESBWR, surrogate AP1000, IRIS, and ACR-700) use sintered UO_2 fuel pellets encapsulated in zircaloy rods. The average enrichment for the ACR-700 fuel is about 2 percent, which is well within the 10 CFR 51.52(a)(2) condition. The average enrichments for the other advanced LWR fuels exceed the 4 percent uranium-235 by weight condition in 10 CFR 51.52(a)(2).

The gas-cooled reactors (i.e., the GT-MHR and PBMR) have substantially different fuel forms than those described in 10 CFR 51.52(a)(2). The fuel forms for these reactors are coated uranium oxycarbide fuel kernels (GT-MHR) or coated uranium dioxide fuel kernels (PBMR). The fuel kernels are coated with layers of pyrolitic carbon and silicone carbide. Thus, these fuel forms are not the same as those specified in 10 CFR 51.52(a)(2). Furthermore, the equilibrium enrichments for these fuels are 12.9 percent (PBMR) and 19.8 percent (GT-MHR).

Shipping Mode

Trucks are used to ship unirradiated fuel to the various sites for all the reactor types (INEEL 2003).

WASH-1238 and Table S–4 of 10 CFR 51.52(c)

The condition specified in Table S–4 that applies to shipment of unirradiated fuel limits the number of shipments of fuel and waste to and from a commercial nuclear power plant to less than one per day. Table H-3 summarizes the number of truck shipments of unirradiated fuel required for each reactor type. The numbers of shipments are normalized to the net electrical generation output for the reference reactor in WASH-1238 (AEC 1972) or 880 MW(e) (1100-MW(e)) plant operating at 80-percent annual capacity factor.

As shown in Table H-3, the ACR-700, PBMR, and GT-MHR advanced reactor types exceed the number of truck shipments estimated for the reference LWR in WASH-1238 (AEC 1972). The largest number of shipments, in excess of 700 shipments over 40 years, is for the GT-MHR. However, the combined number of unirradiated fuel, spent fuel, and radioactive waste shipments per day equate to far less than one truck shipment per day for all reactor types. Consequently, the numbers of shipments for all the advanced reactor types are within the conditions specified in Table S–4 of 10 CFR 51.52. Table S–4 includes a condition that the truck shipments not

Table H-3. Numbers of Truck Shipments of Unirradiated Fuel for Each Advanced Reactor Type

Reactor Type	Number of Shipments per Unit: Initial Core[(a)]	Annual Reload	Total[(b)]	Unit Electric Generation, MW(e)[(c)]	Capacity Factor[(c)]	Normalized, Shipments per 1100 MW(e)[(d,e)]
Reference LWR (WASH-1238)	18	6	252	1100	0.8	252
ABWR/ESBWR[(d,e)]	30	6.1	267	1500[(f)]	0.95	165
Surrogate AP1000	14	3.8	161	1150[(f)]	0.95	130
ACR-700	30	15.4	628	1462[(g)]	0.9	420
IRIS	34	4.3	201	1005[(h)]	0.96	184
GT-MHR	51	20	831	1140[(I)]	0.88	729
PBMR	44	20	824	1320[(j)]	0.95	579

(a) Shipments of the initial core have been rounded up to the next highest whole number.
(b) Total shipments of unirradiated fuel over a 40-year plant lifetime (i.e., initial core load plus 39 years of average annual reload quantities).
(c) Unit capacities and capacity factors were taken from INEEL (2003).
(d) Normalized to net electric output for WASH-1238 reference LWR (i.e., 1100 MW(e) reactor at 80 percent or net electrical output of 880 MW(e)).
(e) Ranges of capacities are given in INEEL (2003) for these reactor unirradiated fuel shipments. The unirradiated fuel shipment data for these reactors were derived using the upper limits of the ranges.
(f) The ABWR/ESBWR unit includes one reactor at 1500 MW(e), and the surrogate AP1000 unit includes one reactor at 1150 MW(e).
(g) The ACR-700 unit includes two reactors at 731 MW(e) per reactor.
(h) The IRIS unit includes three reactors at 335 MW(e) per reactor.
(I) The GT-MHR unit includes four reactors at 285 MW(e) per reactor.
(j) The PBMR unit includes eight reactors at 165 MW(e) per reactor.
Note: The reference LWR shipment values have all been normalized to 880 MW(e) net electrical generation.

exceed 33,100 kg (73,000 lb) as governed by Federal or State gross vehicle weight restrictions. All of the advanced reactors were indicated in INEEL (2003) to be capable of meeting this restriction for unirradiated fuel shipments.

Finally, Table S–4 includes conditions related to radiological doses to transport workers and members of the public along transport routes. These doses are a function of the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time in transit (including travel time and stop time), and the number of shipments to which the individuals are exposed. The radiological dose impacts of the transportation of unirradiated fuel were calculated using the RADTRAN 5 computer code (Neuhauser et al. 2003). The RADTRAN 5 calculations were performed to develop estimates of the worker and public doses associated with annual unirradiated fuel shipments to the ESP sites.

One of the key assumptions in WASH-1238 (AEC 1972) for the reference LWR unirradiated fuel shipments is that the radiation dose rate at 1 m (3 ft) from the transport vehicle is about

0.001 mSv/hr (0.1 mrem/hr). This assumption was also used in the analysis of advanced reactor unirradiated fuel shipments. This assumption is reasonable for all the advanced reactor fuel types because the fuel materials will be low-dose-rate uranium radionuclides and will be packaged similarly (i.e., inside a metal container that provides little radiation shielding). The numbers of shipments per year were obtained by dividing the normalized shipments in Table H-3 by 40 years of operation. Other key input parameters used in the radiation dose analysis for unirradiated fuel are shown in Table H-4.

Table H-4. RADTRAN 5 Input Parameters for Unirradiated Fuel Shipments

Parameter	RADTRAN 5 Input Value	Source
Shipping distance, km	3200	AEC (1972)[(a)]
Travel fraction – rural	0.90	NRC (1977a)
Travel fraction – suburban	0.05	
Travel fraction – urban	0.05	
Population density – rural, persons/km^2	10	DOE (2002a)
Population density – suburban, persons/km^2	349	
Population density – urban, persons/km^2	2260	
Vehicle speed – rural, km/hr	88.49	Based on average speed in rural areas given
Vehicle speed – suburban, km/hr	88.49	in DOE (2002a)
Vehicle speed – urban, km/hr	88.49	
Traffic count – rural, vehicles/hr	530	DOE (2002a)
Traffic count – suburban, vehicles/hr	760	
Traffic count – urban, vehicles/hr	2400	
Dose rate at 1 m from vehicle, mSv/hr	0.001	AEC (1972)
Packaging length, m	7.3	Approximate length of two LWR fuel element packages placed on end
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a)
Stop time, hr/trip	4.5	Based on 0.0014-hour stop time per km (Hostick et al. 1992)
Population density at stops, persons/km^2	64,300	Based on 20 people in annular ring extending from 1 to 10 m (3.3 to 33 ft) from the vehicle

(a) AEC (1972) provides a range of shipping distances between 40 km (25 mi) and 4800 km (3000 mi) for unirradiated fuel shipments. A 3200-km (2000-mi) "average" shipping distance was assumed here.

The RADTRAN 5 results for this "generic" unirradiated fuel shipment are as follows:

- Worker dose: 1.71×10^{-5} person-Sv/shipment (1.71×10^{-3} person-rem/shipment)

- General public dose (onlookers/persons at stops and sharing the highway): 6.65×10^{-5} person-Sv/shipment (6.65×10^{-3} person-rem/shipment)

- General public dose (along route - persons living near a highway): 1.61×10^{-6} person-Sv/shipment (1.61×10^{-4} person-rem/shipment).

These values were combined with the average annual shipments of unirradiated fuel for each advanced reactor type (see Table H-3) normalized to the WASH-1238 (AEC 1972) reference LWR electric output (880 MW(e)) to calculate annual doses to the public and workers. The results are compared to Table S–4 conditions. The results are shown in Table H-5. As shown, the calculated radiation doses for shipping unirradiated fuel to advanced reactor sites are within the conditions shown in Table S–4.

Table H-5. Radiological Impacts of Transporting Unirradiated Fuel to ESP Sites

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose, person-Sv/yr[(a)] per 1100 MW(e) Workers	Public – Onlookers	Public – Along Route
Reference LWR (WASH-1238 (AEC 1972))	6.3	1.1×10^{-4}	4.2×10^{-4}	1.0×10^{-5}
ABWR/ESBWR	4.1	7.1×10^{-5}	2.7×10^{-4}	6.6×10^{-6}
Surrogate AP1000	3.3	5.6×10^{-5}	2.2×10^{-4}	5.2×10^{-6}
ACR-700	10.5	1.8×10^{-4}	7.0×10^{-4}	1.7×10^{-5}
IRIS	4.6	7.9×10^{-5}	3.1×10^{-4}	7.4×10^{-6}
GT-MHR	18.2	3.1×10^{-4}	1.2×10^{-3}	2.9×10^{-5}
PBMR	14.5	2.5×10^{-4}	9.6×10^{-4}	2.3×10^{-5}
10 CFR 51.52, Table S-4 Condition	<1 per day	4×10^{-2}	3.0×10^{-2}	3.0×10^{-2}

(a) Person-Sv = person-sievert; multiply person-Sv/yr times 100 to obtain dose in person-rem/yr.

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposures to low doses below about 100 mSv (10,000 mrem) and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), the BEIR VII report, supports the linear, no-threshold dose response theory. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Based on this model, the staff estimates the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem)) from International Commission on Radiological Protection (ICRP) Publication 60 (ICRP 1991). All the public doses presented in Table H-5 are less than or equal to 0.0012 person-Sv/yr (0.12 person-rem/yr); therefore, the total detriment estimates associated with these doses would all be less than 1×10^{-4} fatal cancers, nonfatal cancers, and severe hereditary effects per year. These risks are very small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually to the same population from exposure to natural sources of radiation, based on the same risk model.

H.2.1.3 Transportation Accidents

Accidents involving unirradiated fuel shipments are also addressed in Table S–4. Accident risks are the product of accident frequency times consequence. Accident frequencies are likely to be lower than they were when WASH-1238 (AEC 1972) was published because traffic accident, injury, and fatality rates have fallen over the past 30 years. Consequences of accidents that are severe enough to result in a release of unirradiated fuel particles are not significantly different for advanced LWRs because the fuel form, cladding, and packaging are similar to those analyzed in WASH-1238. Consequently, the impacts of accidents during transport of unirradiated fuel to advanced LWR sites would be smaller than the WASH-1238 results that formed the basis for Table S–4.

With respect to the advanced gas-cooled reactors, accident rates (accidents per unit distance) and associated accident frequencies (accidents per year) would follow the same trends as for LWRs (i.e., overall reduction relative to the accident rates used in WASH-1238). The consequences of accidents involving gas-cooled reactor unirradiated fuel, however, are more uncertain. A literature search was conducted to identify publicly available documents that describe the effects of accidents (i.e., exposure of unirradiated gas-cooled reactor fuel to structural and thermal transients). No definitive references were found. Consequently, it was assumed that the gas-cooled reactor unirradiated fuel shipments would have the same abilities as LWR unirradiated fuel to maintain functional integrity following a traffic accident. This assumption is judged to be conservative because gas-cooled reactor fuel operates at significantly higher temperatures and thus maintains integrity under more severe thermal conditions than LWR fuel. Detailed information about the behavior of the gas-cooled reactor fuel under impact conditions was not available. However, packaging systems for unirradiated gas-cooled reactor fuel will be required to meet the same performance requirements as unirradiated LWR fuel packages including fissile material controls to prevent criticality under normal and accident conditions. Consequently, packaging systems for unirradiated gas-cooled reactor fuels are expected to provide protection equivalent to those designed for unirradiated LWR fuels. In addition, the fuel forms for the gas-cooled reactors are similar to those for LWRs (i.e., uranium oxide for the PBMR and uranium oxycarbide for the GT-MHR versus uranium oxide for LWRs); thus, the inherent failure resistance provided by unirradiated gas-cooled reactor fuels is expected to be similar to that provided by LWR fuels. Based on the assumption that unirradiated gas-cooled and LWR fuels and associated packaging systems provide similar resistance to various environmental conditions, the staff concluded that the impacts of accidents involving unirradiated gas-cooled reactor fuel are not expected to be significantly different than those for unirradiated LWR fuel.

H.2.2 Spent Fuel Shipping

This section discusses the impact of transporting irradiated or spent advanced reactor fuel from ESP sites to a potential high-level waste repository at Yucca Mountain, Nevada. The section is divided into two parts. The first part considers incident-free transportation, and the second part considers transportation accidents.

The analysis is based on shipment of spent fuel by legal-weight trucks in casks with characteristics similar to casks currently available (i.e., massive, heavily shielded, cylindrical metal pressure vessels). Each shipment is assumed to consist of a single shipping cask loaded onto a modified trailer. These assumptions are consistent with assumptions made in the evaluation of the environmental impacts of transportation of spent fuel presented in Addendum I to NUREG-1437 (NRC 1999). As discussed in Addendum I, these assumptions are conservative because the alternative assumptions involve rail transportation or heavy-haul trucks, which would reduce the number of spent-fuel shipments.

Environmental impacts of the transportation of spent fuel were calculated using the RADTRAN 5 computer code (Neuhauser et al. 2003). Routing and population data for input to RADTRAN 5 for shipment by truck were obtained from the TRAGIS routing code (Johnson and Michelhaugh 2000). The population data in the TRAGIS code is based on the 2000 U.S. Census.

H.2.2.1 Incident-Free Transportation of Spent Fuel

"Incident-free" transportation refers to transportation activities in which the shipments of radioactive material reach their destination without releasing any radioactive cargo to the environment. The vast majority of radioactive shipments are expected to reach their destination without experiencing an accident or incident or releasing any cargo. The "incident-free" impacts from these normal, routine shipments arise from the low levels of radiation that penetrate the heavily shielded spent fuel shipping cask. Although Federal regulations in 10 CFR Part 71 and 49 CFR Part 173 impose constraints on radioactive material shipments, some radiation penetrates the shipping container and exposes nearby persons to low levels of radiation.

Incident-free, legal-weight truck transportation of spent fuel has been evaluated by considering shipments from 11 representative reactor sites to the proposed high-level waste repository at Yucca Mountain, Nevada, (referred to here as the proposed Yucca Mountain repository) for disposal. This assumption is conservative because it tends to maximize the shipping distance from the East Coast and Midwest, where most of the reactors are assumed to be located. Therefore, shipment to one or more other potential sites, such as a monitored retrievable storage facility, would reduce the impacts.

Environmental impacts from these shipments will occur to persons residing along the transportation corridors between the potential advanced reactor sites and the proposed repository; to persons in vehicles passing the spent-fuel shipment; to persons at vehicle stops for refueling, rest, and vehicle inspections; and to transportation crew members. The impacts to these exposed population groups were quantified using the RADTRAN 5 computer code (Neuhauser et al. 2003).

This analysis assumes that all spent nuclear fuel will be transported to the proposed Yucca Mountain repository because Congress has directed (Nuclear Waste Policy Act of 1982, as amended) the U.S. Department of Energy to study only Yucca Mountain for the proposed repository.

The characteristics of specific shipping routes (e.g., population densities and shipping distances) influence the normal radiological exposures. To address the differences that arise from the specific reactor site from which the spent fuel shipment originates, each advanced reactor design was assumed to be located at all of the primary and alternative ESP sites. These sites are:

- Primary Sites
  - North Anna Power Station, Virginia
  - Clinton Nuclear Power Station, Illinois
  - Grand Gulf Nuclear Power Station, Mississippi

- Alternative Sites[(a)]
  - Savannah River Site (SRS), South Carolina
  - Portsmouth Gaseous Diffusion Plant (PGDP), Ohio
  - FitzPatrick Nuclear Power Plant, New York
  - Pilgrim Nuclear Power Station, Massachusetts
  - Zion Nuclear Power Station, Illinois
  - Quad Cities Nuclear Power Station, Iowa
  - Braidwood Nuclear Power Station, Illinois
  - Surry Power Station, Virginia

Input to RADTRAN 5 includes the total shipping distance between the origin and destination sites and the population distributions along the routes. This information was obtained by running the TRAGIS computer code (Johnson and Michelhaugh 2000) for the origin-destination combinations of interest for legal-weight trucks. The resulting route characteristics information is

(a) Impacts were not calculated for the River Bend site because the analysis is bounded by the impacts calculated for Grand Gulf. Impacts were not calculated for the Dresden and LaSalle sites because they are bounded by the Braidwood analysis.

shown in Table H-6. Note that for truck shipments, all the spent fuel is assumed to be shipped to the proposed Yucca Mountain repository over designated controlled-quantity highway routes. The routes used here are the same as those used in the Yucca Mountain Environmental Impact Statement (DOE 2002b).

Table H-6. Transportation Route Information for Shipments from ESP Sites to the Proposed High-Level Waste Repository at Yucca Mountain

ESP Site	One-Way Shipping Distance, km				Population Density, persons/km^2			Stop Time per Trip, hr
	Total	Rural	Suburban	Urban	Rural	Suburban	Urban	
Primary Site								
North Anna	4409.5	3498	812.4	99.1	11.3	319	2310.6	5
Clinton	3076.3	2626.3	398.3	51.7	9.4	306.1	2372.2	3.5
Grand Gulf[(a)]	3718.3	3030.4	581.3	106.6	9.2	339.4	2429.4	4
Alternative Site								
Savannah River Site	4263	3260	881	122	11	331.5	2311.2	5
Portsmouth Gaseous Diffusion Plant	3902.2	3166.9	647.2	88.1	10.7	316.4	2339.7	4.5
FitzPatrick	4212.2	3228.6	875.4	108.2	11.4	312.4	2348.7	5
Pilgrim	4682.3	3469.3	1091.7	121.3	11.8	312.3	2377.2	5.5
Zion	3138.9	2629.6	441.3	68	9.5	323.8	2360.3	3.5
Quad Cities	2853.1	2451	352.6	49.5	9.1	310.2	2391.3	3
Braidwood[(b)]	3034.5	2604.4	378.7	51.4	9.4	308.9	2377.2	3.5
Surry	4555.4	3590.7	863.9	100.8	11.4	317.6	2301.6	5

(a) The River Bend alternative site can be assumed to be bounded by the Grand Gulf values because of the proximity of the sites.
(b) Dresden and LaSalle can be assumed to be bounded by the Braidwood values because of the proximity of the sites.

Shipping casks have not been designed for advanced reactor spent fuel. Although some of the advanced reactor fuel designs are similar to current LWR fuel, no attempt has been made to optimize the cargo capacities of shipping casks for advanced LWR fuels. For the non-LWR fuel types (i.e., the GT-MHR and PBMR), there is little information on even a conceptual basis that would provide a defensible technical basis for shipping-cask capacities. The shipping-cask capacity data in the *Early Site Permit Environmental Report Sections and Supporting Documentation* (INEEL 2003) is summarized as follows:

- ABWR – The ABWR fuel is not significantly different from existing LWR fuel designs; thus, the number of ABWR assemblies that can be transported in a legal-weight truck shipment (i.e., 23 MT [25-ton] shipping cask) is not expected to be different from current cargo capacities.

- ESBWR – The ESBWR fuel is similar to the ABWR fuel.

- Surrogate AP1000 – The surrogate AP1000 fuel assemblies are similar to current-generation PWR fuel. No information was provided in INEEL (2003) on shipping cask capacities for surrogate AP1000 spent nuclear fuel.

- ACR-700 – The ACR-700 fuel is somewhat different from the current and advanced LWR fuel designs. System Energy Resources, Inc. (SERI) estimated that an ACR-700 rail cask would hold about 10 MTU of spent fuel, similar to the current cask designs. This value is nearly identical to the cargo capacities of current rail cask designs; thus, it was assumed that the truck cask capacity for ACR-700 and current-generation LWRs would also be about the same (i.e., 1.8 MTU/shipment).

- IRIS – The IRIS fuel is similar to current-generation PWR fuel. No information was provided in INEEL (2003) on shipping-cask capacities for IRIS spent nuclear fuel.

- GT-MHR – The GT-MHR fuel is a spherical coated-particle fuel with a uranium oxycarbide fuel kernel loaded into graphite fuel assemblies. This fuel concept is significantly different from current and advanced LWR fuels (sintered UO_2 pellets loaded into zircaloy tubes). According to INEEL (2003), six spent fuel assemblies containing 0.023 MTU of spent fuel is assumed to be transported in a legal weight truck cask.

- PBMR – The PBMR fuel is also a spherical coated-particle fuel with uranium oxide fuel kernels. INEEL (2003) estimated that 0.495 MTU of spent PBMR fuel can be transported in a single legal-weight truck shipment.

These shipping cask capacities are approximations based on current shipping cask designs. Actual shipping cask capacities in the future may be significantly different. Applicants must account for changes in shipping cask capacities in applications at the construction permit or combined operating license stage.

Incident-free radiation doses are a function of many variables. The most important of these variables are presented in Table H-7. Most of these variables, which are extracted from the literature, are considered to be “standard” values used in many RADTRAN 5 applications, including environmental impact statements and regulatory analyses.

Table H-7. RADTRAN 5 Incident-Free Exposure Parameters

Parameter	RADTRAN 5 Input Value	Source
Vehicle speed – rural, km/hr	88.49	Based on average speed in rural areas given in DOE (2002a). Because most travel is on interstate highways, the same vehicle speed is assumed in rural, suburban, and urban areas. No speed reductions were assumed for travel at rush hour.
Vehicle speed – suburban, km/hr	88.49	
Vehicle speed – urban, km/hr	88.49	
Traffic count – rural, vehicles/hr	530	DOE (2002a)
Traffic count – suburban, vehicles/hr	760	
Traffic count – urban, vehicles/hr	2400	
Dose rate at 1 m from vehicle, mSv/hr	0.14	Approximate dose rate at 1 m (3 ft) that is equivalent to maximum dose rate allowed by the U.S. Department of Transportation and NRC regulations (i.e., 0.1 mSv/hr at 2 m (~7 ft) from the side of a transport vehicle) (DOE 2002b)
Packaging dimensions, m	Length – 5.2 Diameter – 1.0	DOE (2002b)
Number of truck crew	2	(AEC 1972; NRC 1977a; DOE 2002a)
Stop time, hr/trip	Route-specific	See Table H-6.
Population density at stops, persons/km^2	30,000	Sprung et al. (2000)
Min/max radii of annular area around vehicle at stops, m	1 to 10	Sprung et al. (2000)
Shielding factor applied to annular area surrounding vehicle at stops	1 (no shielding)	Sprung et al. (2000)
Population density surrounding truck stops, persons/km^2	340	Sprung et al. (2000)
Min/max radius of annular area surrounding truck stop, m	10 to 800	Sprung et al. (2000)
Shielding factor applied to annular area surrounding truck stop	0.2	Sprung et al. (2000)

For purposes of this Section H.2 analysis, the transportation crew for spent fuel shipments delivered by truck is assumed to consist of two drivers. Escorts were considered, but they were not included because their distance from the shipping cask would reduce the dose rates to levels well below the dose rates experienced by the drivers. Stop times were assumed to accrue at the rate of 30 minutes per 4-hour driving time. TRAGIS outputs were used to determine the number of stops for each origin-destination.

Doses to the public at truck stops have been significant contributors to the doses calculated in previous RADTRAN 5 analyses. For this Section H.2 analysis, stop doses are the sum of the doses to individuals located in two annular rings centered at the stopped vehicle, as illustrated in Figure H-1. The inner ring represents persons who may be at the truck stop at the same time as a spent fuel shipment and extends 1 to 10 m from the edge of the vehicle. The outer ring represents persons who reside near a truck stop and extends from 10 to 800 m from the vehicle. This scheme is the same as that used in Sprung et al. (2000).

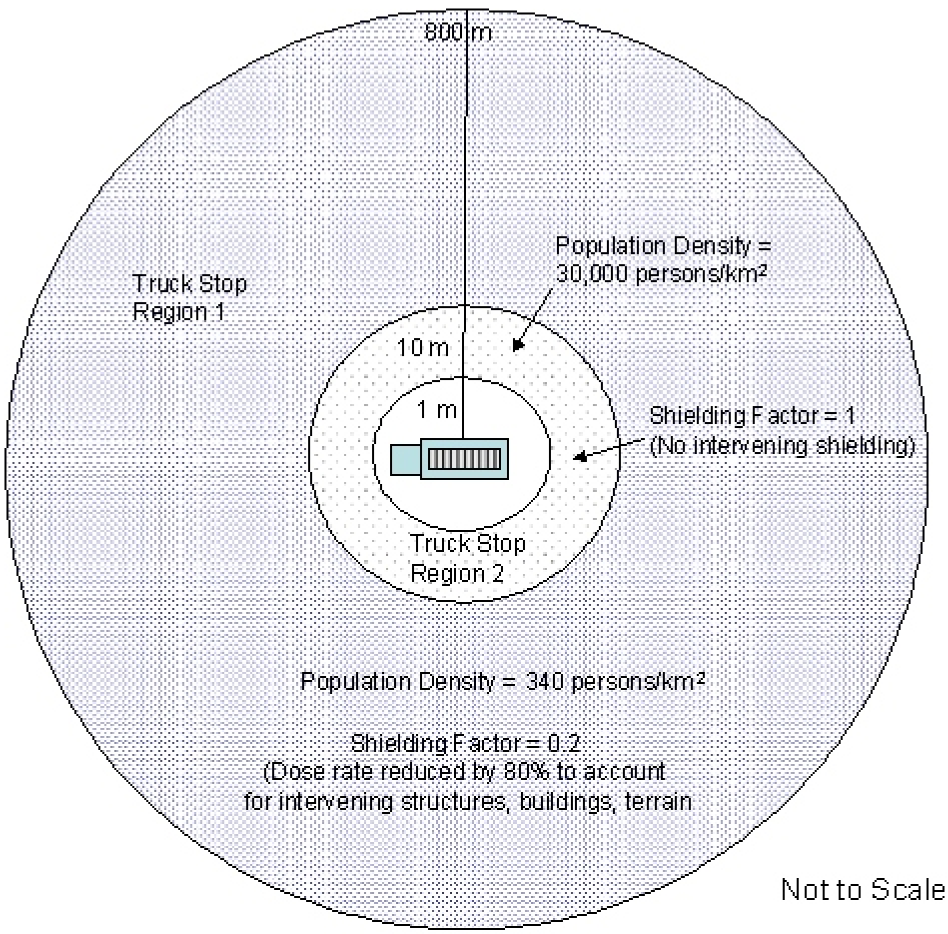

Figure H-1. Illustration of Truck Stop Model (Sprung et al. 2000)

Population densities and shielding factors were also taken from Sprung et al. (2000) and were based on the observations of Griego et al. (1996).

The results of these routine (incident-free) exposure calculations are shown in Table H-8 for spent fuel shipments from all 11 primary and alternative sites to the proposed Yucca Mountain repository. Population dose estimates are given for workers (i.e., truck crew members), onlookers (doses to persons at truck stops and persons and on highways exposed to the spent fuel shipments), and along the route (persons living near the highway).

Table H-8. Routine (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from Potential ESP Sites to the Proposed High-Level Waste Repository at Yucca Mountain

	Population Dose, person-Sv/shipment[a]		
Reactor Site	**Crew**	**Onlookers**	**Along Route**
Braidwood[b]	7.1×10^{-4}	2.4×10^{-3}	4.4×10^{-5}
Clinton	7.2×10^{-4}	2.5×10^{-3}	4.5×10^{-5}
FitzPatrick	9.8×10^{-4}	3.5×10^{-3}	9.5×10^{-5}
Grand Gulf[c]	8.7×10^{-4}	2.8×10^{-3}	7.0×10^{-5}
North Anna	1.0×10^{-3}	3.5×10^{-3}	9.2×10^{-5}
Pilgrim	1.1×10^{-3}	3.9×10^{-3}	1.2×10^{-4}
Portsmouth	9.1×10^{-4}	3.2×10^{-3}	7.3×10^{-5}
Quad Cities	6.7×10^{-4}	2.1×10^{-3}	4.1×10^{-5}
Savannah River	9.9×10^{-4}	3.5×10^{-3}	1.0×10^{-4}
Surry	1.1×10^{-3}	3.5×10^{-3}	9.7×10^{-5}
Zion	7.3×10^{-4}	2.5×10^{-3}	5.2×10^{-5}

(a) Multiply person-Sv/shipment by 100 to obtain doses in person-rem/shipment.
(b) The River Bend alternative site can be assumed to be bounded by the Grand Gulf values because of the proximity of the sites.
(c) Dresden and LaSalle can be assumed to be bounded by the Braidwood values because of the proximity of the sites.

This discussion addresses whether or not the environmental effects of incident-free advanced reactor spent fuel shipments are within the guidelines established in Table S–4. The bounding cumulative doses to the exposed population given in Table S–4 are:

- Transport workers — 0.04 person-Sv (4 person-rem) per reference reactor year.
- General public (onlookers and along route) — 0.03 person-Sv (3 person-rem) per reference reactor year.

Calculation of the cumulative doses entailed converting the per-shipment risks given in Table H-8 to estimates of environmental effects per reference reactor year of operation. The per-shipment results, which are independent of reactor type (i.e., the doses are dependent on the assumed external radiation dose rate emitted from the cask, which is fixed at the regulatory maximum limit for all of the advanced reactor types), are given in terms of the population dose per shipment of spent fuel. To develop estimates of the annual environmental impacts, the following assumptions were made:

- The basis for the annual number of shipments of spent fuel from the reference LWR in WASH-1238 (AEC 1972) will be used. In WASH-1238, it was assumed that 60 shipments per year would be made, each shipment carrying 0.5 MTU of spent fuel. This equates to shipping 30 MTU of spent fuel per year. This is equivalent to the annual refueling requirements for the reference LWR. It was assumed that the other reactor types would also ship spent fuel at a rate equal to their annual refueling requirements.

- Shipping cask capacities that were used to calculate annual spent fuel shipments for the advanced LWRs were assumed to be the same as for the reference LWR (i.e., approximately 0.5 MTU per truck shipment).

- The annual numbers of spent fuel shipments from the advanced gas-cooled reactors were taken directly from INEEL (2003). These estimates were 34 shipments per year from a GT-MHR site and 12 shipments per year from the PBMR site.

Table H-9 provides the estimated annual population doses from routine (incident-free) transportation of spent fuel from ESP sites to the proposed Yucca Mountain repository. The results in Table H-9 have been normalized to the WASH-1238 (AEC 1972) net electrical generation (i.e., 880 MW(e)). Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses below about 100 mSv (10,000 mrem) and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report (National Research Council 2006), the BEIR VII report, supports the linear, no-threshold dose response theory. Simply put, the theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks.

Based on this model, the staff estimates the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv [1,000,000 person-rem]) from International Commission on Radiological Protection (ICRP) Publication 60 (ICRP 1991). All the population doses presented in Table H-9 are less than one person-Sv/yr (100 person-rem/yr); therefore, the total detriment estimates associated with these population doses would all be less than 0.1 fatal cancers, nonfatal cancers, and severe hereditary effects per year. These risks are very small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would occur annually in the same population from exposure to natural sources of radiation.

As shown in Table H-9, some of the estimated population doses are higher than the Table S–4 conditions. Two key reasons for the higher population doses relative to Table S–4 are the higher number of spent fuel shipments estimated for some of the reactor technologies and the longer shipping distances used in this assessment than were used in WASH-1238 (AEC 1972). WASH-1238 used a “typical” distance for a spent fuel shipment of 1600 km (1000 mi), whereas the shipping distances used in this assessment ranged from about 2900 km (1800 mi) to 4700 km (2900 mi). The higher numbers of shipments are based on spent fuel shipping-casks designed to transport short-cooled fuel (150 days out of the reactor). It was assumed in this analysis that the shipping-cask capacities are 0.5 MTU/shipment, roughly equivalent to one PWR or two BWR spent fuel assemblies per shipment. Newer designs are based on longer-cooled spent fuel (5 years out of reactor) and have larger capacities than those used in this assessment. DOE (2002b) spent fuel shipping-cask capacities were approximately 1.8 MTU/shipment, or up to four PWR or nine BWR fuel assemblies per shipment. Use of the newer shipping-cask designs will reduce the number of spent fuel shipments and the associated environmental impacts. If the population doses are adjusted for the shipping distance (a factor of 2 to 3) and shipping cask capacity (a factor of 4), the routine population doses from spent fuel shipments from all reactor types and all sites fall within the Table S–4 conditions.

Most of the stops made for actual spent fuel shipments are short duration stops (i.e., 10 minutes) for brief visual inspections of the cargo (e.g., checking the cask tie-downs). These stops typically occur in areas devoid of people, such as overpasses or freeway ramps in unpopulated areas. Therefore, doses to residents surrounding these types of stops are negligible. In DOE (2002b), close-proximity exposures (i.e., from 1 to 15.8 m from the cask) were not assumed to occur at the short-duration inspection stops. In this analysis, for the purpose of developing bounding estimates of environmental effects, close-proximity (1 to 10 m from cask) exposures at all truck stops were included in the RADTRAN 5 calculations. Because the numbers of stops in this analysis are effectively doubled relative to DOE (2002b), truck stop doses are also doubled. The doses to residents would also be lower; however, because doses to residents are two to three orders of magnitude (i.e., a factor of 100 to 1000) less than the calculated close-proximity doses, this reduction does not affect the total stop dose.

The number of exposed persons at stops is higher in this Section H.2 analysis by about a factor of 1.5 relative to DOE (2002b) assumptions (6.9 persons in DOE 2002b versus 10 persons assumed in this analysis). Thus, the bounding doses calculated in this analysis are also a factor of 1.5 (10 divided by 6.9) greater than those given in DOE (2002b). Furthermore, empirical data provided in Griego et al. (1996) indicate that a 30-minute stop is toward the high end of the stop time distribution. Average stop times for food and refueling observed by Griego et al. (1996) are on the order of 18 minutes. This amounts to another factor of 1.5 increase in stop doses calculated here relative to DOE (2002b).

Table H-9. Routine (Incident-Free) Population Doses from Spent Fuel Transportation, Normalized to Reference LWR Net Electrical Generation

Reactor Type	Reference LWR (WASH-1238)			ABWR/ESBWR			Surrogate AP1000			ACR-700		
No. Shipments per year	60			41			40			90		
	Environmental Effects, person-Sv per reference reactor year[a]											
Reactor Site	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route	Crew	Onlookers	Along Route
Braidwood[b]	4.2×10^{-2}	1.5×10^{-1}	2.6×10^{-3}	2.9×10^{-2}	1.0×10^{-1}	1.8×10^{-3}	2.8×10^{-2}	9.7×10^{-2}	1.7×10^{-3}	6.3×10^{-2}	2.2×10^{-1}	3.9×10^{-3}
Clinton	4.3×10^{-2}	1.5×10^{-1}	2.7×10^{-3}	2.9×10^{-2}	1.0×10^{-1}	1.8×10^{-3}	2.8×10^{-2}	9.7×10^{-2}	1.8×10^{-3}	6.4×10^{-2}	2.2×10^{-1}	4.1×10^{-3}
FitzPatrick	5.9×10^{-2}	2.1×10^{-1}	5.7×10^{-3}	4.0×10^{-2}	1.4×10^{-1}	3.9×10^{-3}	3.9×10^{-2}	1.4×10^{-1}	3.8×10^{-3}	8.8×10^{-2}	3.1×10^{-1}	8.5×10^{-3}
Grand Gulf[c]	5.2×10^{-2}	1.7×10^{-1}	4.2×10^{-3}	3.5×10^{-2}	1.2×10^{-1}	2.8×10^{-3}	3.4×10^{-2}	1.1×10^{-1}	2.7×10^{-3}	7.8×10^{-2}	2.5×10^{-1}	6.2×10^{-3}
North Anna	6.2×10^{-2}	2.1×10^{-1}	5.5×10^{-3}	4.2×10^{-2}	1.4×10^{-1}	3.7×10^{-3}	4.1×10^{-2}	1.4×10^{-1}	3.6×10^{-3}	9.2×10^{-2}	3.2×10^{-1}	8.2×10^{-3}
Pilgrim	6.5×10^{-2}	2.3×10^{-1}	7.0×10^{-3}	4.4×10^{-2}	1.6×10^{-1}	4.8×10^{-3}	4.3×10^{-2}	1.5×10^{-1}	4.6×10^{-3}	9.8×10^{-2}	3.5×10^{-1}	1.0×10^{-2}
Portsmouth	5.5×10^{-2}	1.9×10^{-1}	4.4×10^{-3}	3.7×10^{-2}	1.3×10^{-1}	3.0×10^{-3}	3.6×10^{-2}	1.2×10^{-1}	2.9×10^{-3}	8.1×10^{-2}	2.8×10^{-1}	6.6×10^{-3}
Quad Cities	4.0×10^{-2}	1.3×10^{-1}	2.4×10^{-3}	2.7×10^{-2}	8.6×10^{-2}	1.7×10^{-3}	2.6×10^{-2}	8.4×10^{-2}	1.6×10^{-3}	6.0×10^{-2}	1.9×10^{-1}	3.6×10^{-3}
Savannah River	6.0×10^{-2}	2.1×10^{-1}	6.0×10^{-3}	4.0×10^{-2}	1.4×10^{-1}	4.1×10^{-3}	3.9×10^{-2}	1.4×10^{-1}	4.0×10^{-3}	8.9×10^{-2}	3.2×10^{-1}	9.0×10^{-3}
Surry	6.4×10^{-2}	2.1×10^{-1}	5.8×10^{-3}	4.3×10^{-2}	1.4×10^{-1}	3.9×10^{-3}	4.2×10^{-2}	1.4×10^{-1}	3.8×10^{-3}	9.5×10^{-2}	3.2×10^{-1}	8.7×10^{-3}
Zion	4.4×10^{-2}	1.5×10^{-1}	3.1×10^{-3}	3.0×10^{-2}	1.0×10^{-1}	2.1×10^{-3}	2.9×10^{-2}	9.7×10^{-2}	2.0×10^{-3}	6.5×10^{-2}	2.2×10^{-1}	4.6×10^{-3}

Table H-9. (contd)

Reactor Type	IRIS			GT-MHR			PBMR		
No. Shipments per year	35			34			12		
	Environmental Effects, person-rem per reference reactor year[(a)]								
Reactor Site	**Crew**	**Onlookers**	**Along Route**	**Crew**	**Onlookers**	**Along Route**	**Crew**	**Onlookers**	**Along Route**
Braidwood	2.5×10^{-2}	8.5×10^{-2}	1.5×10^{-3}	2.4×10^{-2}	8.2×10^{-2}	1.5×10^{-3}	7.9×10^{-3}	2.7×10^{-2}	4.9×10^{-4}
Clinton	2.5×10^{-2}	8.5×10^{-2}	1.6×10^{-3}	2.4×10^{-2}	8.2×10^{-2}	1.5×10^{-3}	8.0×10^{-3}	2.8×10^{-2}	5.1×10^{-4}
FitzPatrick	3.4×10^{-2}	1.2×10^{-1}	3.3×10^{-3}	3.3×10^{-2}	1.2×10^{-1}	3.2×10^{-3}	1.1×10^{-2}	3.9×10^{-2}	1.1×10^{-3}
Grand Gulf	3.0×10^{-2}	9.8×10^{-2}	2.4×10^{-3}	2.9×10^{-2}	9.4×10^{-2}	2.3×10^{-3}	9.7×10^{-3}	3.2×10^{-2}	7.8×10^{-4}
North Anna	3.6×10^{-2}	1.2×10^{-1}	3.2×10^{-3}	3.4×10^{-2}	1.2×10^{-1}	3.1×10^{-3}	1.2×10^{-2}	4.0×10^{-2}	1.0×10^{-3}
Pilgrim	3.8×10^{-2}	1.3×10^{-1}	4.0×10^{-3}	3.6×10^{-2}	1.3×10^{-1}	3.9×10^{-3}	1.2×10^{-2}	4.3×10^{-2}	1.3×10^{-3}
Portsmouth	3.1×10^{-2}	1.1×10^{-1}	2.5×10^{-3}	3.0×10^{-2}	1.1×10^{-1}	2.4×10^{-3}	1.0×10^{-2}	3.6×10^{-2}	8.2×10^{-4}
Quad Cities	2.3×10^{-2}	7.4×10^{-2}	1.4×10^{-3}	2.2×10^{-2}	7.1×10^{-2}	1.4×10^{-3}	7.5×10^{-3}	2.4×10^{-2}	4.6×10^{-4}
Savannah River	3.4×10^{-2}	1.2×10^{-1}	3.5×10^{-3}	3.3×10^{-2}	1.2×10^{-1}	3.3×10^{-3}	1.1×10^{-2}	3.9×10^{-2}	1.1×10^{-3}
Surry	3.7×10^{-2}	1.2×10^{-1}	3.3×10^{-3}	3.5×10^{-2}	1.2×10^{-1}	3.2×10^{-3}	1.2×10^{-2}	4.0×10^{-2}	1.1×10^{-3}
Zion	2.5×10^{-2}	8.5×10^{-2}	1.8×10^{-3}	2.4×10^{-2}	8.2×10^{-2}	1.7×10^{-3}	8.2×10^{-3}	2.8×10^{-2}	5.8×10^{-4}

(a) Multiply person-Sv/yr by 100 to obtain doses in person-rem/yr.
(b) The River Bend alternative site can be assumed to be bounded by the Grand Gulf values because of the proximity of the sites.
(c) Dresden and LaSalle can be assumed to be bounded by the Braidwood values because of the proximity of the sites.

Based on these observations, the staff concluded that the stop model used in this study overestimates public doses at stops by approximately a factor of four (factor of two for close-proximity exposure time at stops, a factor of 1.5 for average stop time at food and refueling stops, and a factor of 1.5 for the number of people in proximity to the shipping cask). Coupled with the factor of two reduction in shipping cask dose rates that result from fuel aging, the doses to onlookers at stops could be reduced to about one-eighth of the doses shown in Table H-9 [1/(2 x 1.5 x 1.5 x 2) ≈ 0.12] to reflect more realistic truck shipping conditions. Based on the previous discussion, use of more realistic dose rates, shipping cask capacities, and truck stop model assumptions in the RADTRAN 5 calculations could substantially reduce the environmental effects presented in Table H-9.

Table H-10 provides a comparison between the radiological incident-free doses calculated in NUREG-0170 (NRC 1977a) and those calculated here. The table also summarizes the key incident-free input parameters used in NUREG-0170 and in this study. Comparisons are also made between the doses for spent fuel shipments in NUREG-0170 and doses calculated for a shipment from the Quad Cities, Iowa, to the proposed Yucca Mountain repository because the shipping distances are comparable (2530 km in NUREG-0170 versus 2853 km for Quad Cities to Yucca Mountain). As shown in the table, many parameters have changed over the years and the technical bases for them have improved. For example, the work of Griego et al. (1996) has improved the basis for assumptions about stop times and persons exposed at truck stops, and the TRAGIS computer code has improved the basis for shipping distances and population distributions along highway routes.

The incident-free impacts at truck stops shown in the table have been adjusted, as discussed above, to reflect more realistic conditions than assumed in the bounding analysis. Adjustments were not made to the onlookers, along route, and crew doses shown in Table H-9. As shown, the adjusted doses in Table H-10 for spent fuel shipments from the Quad Cities to the proposed Yucca Mountain repository are about a factor of two lower than the per-shipment doses from NUREG-0170 when the doses to and doses associated with in-transit storage from NUREG-0170 are excluded. Storage doses were excluded from this Section H.2 analysis because spent fuel shipments proceed directly from the reactor site to Yucca Mountain with no intermediate storage involved. Handler doses were excluded from this analysis because doses to workers who load the spent fuel cask at reactors and unload them at the proposed repository are treated as facility doses, not transportation doses.

Table H-10. Comparison of Incident-Free Doses from NUREG-0170 (NRC 1977a) Spent Fuel Shipments and Spent Fuel Shipment from Quad-Cities to the Proposed High-Level Waste Repository at Yucca Mountain

Incident-Free Exposure Parameter	NUREG-0170 (NRC 1977a)	This Study (Quad Cities to Yucca Mountain)[a]
One-way shipping distance, km	2530	2853
Travel fraction		
Urban	0.05	0.02
Suburban	0.05	0.12
Rural	0.9	0.86
Population density along highway, persons per km^2		
Urban	3861	2391.3
Suburban	719	310.2
Rural	6	9.1
Speed, km/hr		
Urban	24	88
Suburban	40	88
Rural	88	88
Traffic count, vehicles/hr		
Urban	2800	2400
Suburban	780	760
Rural	470	530
Shipment dose Rate, mSv/hr at 2m	0.1	0.1
Crew dose rate, mSv/hr	0.02	Calculated (7.4 m from package)
Stop time, hr per trip		
Urban	2	3 hours per trip (30 minutes per 4 hours driving time)
Suburban	5	
Rural	1	
Population density at stops (per km^2)		
Urban	3861	Distribution: 1 to 10 m - 30,000; 10 to 800 m - 340 (see Figure G-1)
Suburban	719	
Rural	6	
Person-Sv/shipment		
Crew	1.2×10^{-3}	4.8×10^{-4}
Off-link	1.5×10^{-4}	3.1×10^{-4}
On-link	7.4×10^{-5}	1.7×10^{-4}
Stops	1.9×10^{-4}	1.7×10^{-4}[b]
Total	1.6×10^{-3}	8.5×10^{-4}
Handlers + Storage	2.1×10^{-3}	Not calculated
Grand Total	$\mathbf{3.7 \times 10^{-3}}$	$\mathbf{8.5 \times 10^{-4}}$

(a) Tables H-7 and H-9 provide the basis for these input parameters.
(b) Stop doses have been adjusted as described in the text to reflect more realistic assumptions than were used in the bounding analysis (Table H-9).

H.2.2.2 Transportation Accident Impacts

RADTRAN 5 assesses accident risk by calculating a risk value, which is the product of probabilities and the consequences of accidents. RADTRAN 5 considers a spectrum of potential transportation accidents, ranging from those with high frequencies and low consequences (e.g., “fender-benders”) to those with low frequencies and high consequences (e.g., accidents in which the shipping container is exposed to severe mechanical and thermal conditions).

Radionuclide inventories are important parameters in the calculation of accident risks. The radionuclide inventories used in this analysis were taken directly from the *Early Site Permit Environmental Report Sections and Supporting Documentation* (INEEL 2003). The report included hundreds of radionuclides for each advanced reactor type. A screening analysis was conducted to select the dominant contributors to accident risks to simplify the RADTRAN 5 calculations. The screening identifies the radionuclides that will contribute more than 99.999 percent of the dose from inhalation.

A sum-of-fractions approach was used for this screening. First, the inventory of each radionuclide was multiplied by its respective inhalation dose conversion factor, taken from Federal Guidance Report 13 (EPA 2002). These values were then summed. Then, each inventory-conversion factor product was divided by the sum of the products to obtain the fraction of the total inhalation dose for each radionuclide. The resulting fractions were then sorted from largest to smallest, their cumulative contributions were calculated, and those that contributed to 99.999 percent of the inhalation-dose potential were selected. Two gases, krypton-85 and iodine-129, were added to the list because they are more easily released than the solid and semi-volatile species contained in the fuel.

The inventories of radionuclides used in this study are shown in Table H-11. Note that the list of radionuclides provided in the table includes all of the radionuclides that were included in the analysis conducted by Sprung et al. (2000), which validates the screening process used in this EIS. Also note that INEEL (2003) did not provide radionuclide source terms for radioactive material deposited on the external surfaces of LWR spent fuel rods, which is commonly referred to as “crud.” In addition, data on activation products was provided for only the ABWR. The ABWR spent fuel transportation risks were calculated assuming the entire Co-60 inventory is in the form of crud. This is very conservative as the source term used here is about two orders of magnitude greater than that given in Sprung et al. (2000). Because crud is deposited from corrosion products generated elsewhere in the reactor cooling system and the complete reactor design and operating parameters are uncertain, the quantities and characteristics of crud deposited on advanced reactor spent fuel are unknown at this time. Consequently, the impacts of crud and activation products on spent fuel transportation accident risks will need to be examined at the construction permit or combined operating license stage.

Table H-11 shows that the dominant radionuclides are approximately the same regardless of fuel type. The table does not show radionuclide inventory data for the ACR-700 and IRIS advanced reactors, as those were not given in INEEL (2003). Nor were they provided in WASH-1238 (AEC 1972) for the reference LWR. Consequently, accident risks were not quantified for these reactor types.

Table H-11. Radionuclide Inventories Used in the Transportation Accident Risk Calculations for Each Advanced Reactor Type

Radionuclide	ABWR and ESBWR Inventory, Bq/MTU[(a)]	Surrogate AP1000 Inventory, Bq/MTU	GT-MHR Inventory, Bq/MTU	PBMR Inventory, Bq/MTU
Am-241	4.96×10^{13}	2.69×10^{13}	8.18×10^{13}	7.55×10^{13}
Am-242m	1.24×10^{12}	4.85×10^{11}	5.03×10^{11}	8.51×10^{11}
Am-243	1.20×10^{12}	1.24×10^{12}	5.14×10^{11}	4.77×10^{12}
Ce-144	4.22×10^{14}	3.28×10^{14}	2.15×10^{15}	1.19×10^{15}
Cm-242	2.04×10^{12}	1.05×10^{12}	1.51×10^{12}	2.78×10^{12}
Cm-243	1.37×10^{12}	1.14×10^{12}	2.02×10^{11}	1.96×10^{12}
Cm-244	1.80×10^{14}	2.87×10^{14}	2.83×10^{13}	5.48×10^{14}
Cm-245	2.43×10^{10}	4.48×10^{10}	1.65×10^{8}	5.29×10^{10}
Co-60	1.01×10^{14}	--[(b)]	--[(b)]	--[(b)]
Cs-134	1.78×10^{15}	1.78×10^{15}	2.21×10^{15}	4.03×10^{15}
Cs-137	4.59×10^{15}	3.44×10^{15}	1.08×10^{16}	1.41×10^{16}
Eu-154	3.81×10^{14}	3.38×10^{14}	3.23×10^{14}	3.74×10^{14}
Eu-155	1.93×10^{14}	1.71×10^{14}	8.77×10^{13}	1.08×10^{14}
I-129	1.55×10^{9}	1.55×10^{9}	1.55×10^{9}	1.55×10^{9}
Kr-85	3.29×10^{14}	3.29×10^{14}	3.29×10^{14}	3.29×10^{14}
Pm-147	1.25×10^{15}	6.51×10^{14}	6.92×10^{15}	5.07×10^{15}
Pu-238	2.27×10^{14}	2.25×10^{14}	1.17×10^{14}	4.55×10^{14}
Pu-239	1.43×10^{13}	9.44×10^{12}	2.25×10^{13}	1.11×10^{13}
Pu-240	2.28×10^{13}	2.01×10^{13}	3.96×10^{13}	3.32×10^{13}
Pu-241	4.51×10^{15}	2.58×10^{15}	8.33×10^{15}	7.18×10^{15}
Pu-242	8.29×10^{10}	6.73×10^{10}	1.56×10^{11}	4.51×10^{11}
Ru-106	6.07×10^{14}	5.74×10^{14}	1.48×10^{15}	1.68×10^{15}
Sb-125	1.99×10^{14}	1.42×10^{14}	2.21×10^{14}	2.51×10^{14}
Sr-90	3.27×10^{15}	2.29×10^{15}	8.95×10^{15}	1.08×10^{16}
Y-90	3.27×10^{15}	2.29×10^{15}	8.95×10^{15}	1.08×10^{16}

(a) To convert Bq/MTU to Ci/MTU, divide the value by 3.7×10^{10}.
(b) Co-60 is an activation product. Only the ABWR/ESBWR submittal in INEEL (2003) provided inventory data for activation products.

Robust shipping casks are used to transport spent fuel because of the heavy radiation shielding and accident resistance required by 10 CFR Part 71. Spent fuel shipping casks must be certified Type B packaging systems, which means they must withstand a series of severe hypothetical accident conditions with essentially no loss of containment or shielding capability. These casks are also designed with fissile material controls to ensure that the spent fuel remains subcritical under both normal and accident conditions. The tests include a 9-m (30-ft) free drop onto an unyielding surface, a drop onto a puncture probe, an exposure to an engulfing 800°C fire for 30 minutes, and an underwater immersion. According to Sprung et al. (2000), the probability of encountering accident conditions more severe than these tests that could lead to shipping cask failure are less than 0.01 percent of all accidents (i.e., more than 99.99 percent of all accidents would not result in a release of radioactive material from the shipping cask). It was assumed that shipping casks for advanced reactor spent fuels will provide equivalent mechanical and thermal protection of the spent fuel cargo.

The RADTRAN 5 accident risk calculations were performed using unit radionuclide inventories (Bq/MTU) for the spent fuel shipments from the various reactor types. The resulting risk estimates were then multiplied by assumed annual spent fuel shipments (MTU/yr) to derive estimates of the annual accident risks associated with spent fuel shipments from each potential ESP site. As was done for routine exposures, it was assumed that the numbers of shipments of spent fuel per year are equivalent to the annual discharge quantities: 32.76 MTU/yr for the ABWR and ESBWR; 24.4 MTU/yr for a single-reactor surrogate AP1000 site; 6.8 MTU/yr for the four-reactor GT MHR site; and 8.3 MTU/yr for the eight-reactor PBMR site. These data were taken from INEEL (2003) and have not been normalized to the reference LWR net electrical generation.

Route-specific accident rates (accidents per km) were derived for the RADTRAN 5 accident risk analysis. The approach used to develop accident rates for spent fuel shipments is as follows. The TRAGIS data provide estimates of the distance traveled in each state along a route and the type of highway (interstate, state highway, or other). Saricks and Tompkins (1999) provide accident rates for each state that are a function of highway type. The approach taken to estimate route-specific accident rates was to multiply the state-level accident or fatality rates by the distances traveled in each state on the corresponding highway type and then sum over all the states on each route. For example, for interstate highways, the interstate distances and interstate accident rates were used. For non-interstate highway travel, either the “Primary” or “Other” accident rates given by Saricks and Tompkins (1999) were used. This approach allowed computation of route-specific accident rates.

Transportation accident risk analysis in RADTRAN 5 is performed using an accident severity and package release model. The user can define up to 30 severity categories, with each category increasing in magnitude. Severity categories are related to fire, puncture, crush, and immersion environments created in vehicular accidents. For this analysis, the 19 severity categories defined by Sprung et al. (2000) were adopted.

Each severity category has an assigned conditional probability (or the probability, given an accident occurs, that it will be of the specified severity). The accident scenarios are further defined by allowing the user to input release fractions and aerosol and respirable fractions for each severity category. These fractions are a function of the physical-chemical properties of the materials being transported as well as the mechanical and thermal accident conditions that define the severity categories. The severity and release fractions used here are presented in Table H-12.

Table H-12. Severity and Release Fractions Used to Model Spent Fuel Transportation Accidents (Sprung et al. 2000)

Severity Category	Severity Fraction[b]	Release Fractions[a]				
		Gas	Cesium	Ruthenium	Particulates	Corrosion Products
1	1.53×10^{-8}	0.8	2.4×10^{-8}	6.0×10^{-7}	6.0×10^{-7}	2.0×10^{-3}
2	5.88×10^{-5}	0.14	4.1×10^{-9}	1.0×10^{-7}	1.0×10^{-7}	1.4×10^{-3}
3	1.81×10^{-6}	0.18	5.4×10^{-9}	1.3×10^{-7}	1.3×10^{-7}	1.8×10^{-3}
4	7.49×10^{-8}	0.84	3.6×10^{-5}	3.8×10^{-6}	3.8×10^{-6}	3.2×10^{-3}
5	4.65×10^{-7}	0.43	1.3×10^{-8}	3.2×10^{-7}	3.2×10^{-7}	1.8×10^{-3}
6	3.31×10^{-9}	0.49	1.5×10^{-8}	3.7×10^{-7}	3.7×10^{-7}	2.1×10^{-3}
7	0	0.85	2.7×10^{-5}	2.1×10^{-6}	2.1×10^{-6}	3.1×10^{-3}
8	1.13×10^{-8}	0.82	2.4×10^{-8}	6.1×10^{-7}	6.1×10^{-7}	2.0×10^{-2}
9	8.03×10^{-11}	0.89	2.7×10^{-8}	6.7×10^{-7}	6.7×10^{-7}	2.2×10^{-3}
10	0	0.91	5.9×10^{-6}	6.8×10^{-7}	6.8×10^{-7}	2.5×10^{-3}
11	1.44×10^{-10}	0.82	2.4×10^{-8}	6.1×10^{-7}	6.1×10^{-7}	2.0×10^{-3}
12	1.02×10^{-12}	0.89	2.7×10^{-8}	6.7×10^{-7}	6.7×10^{-7}	2.2×10^{-3}
13	0	0.91	5.9×10^{-6}	6.8×10^{-7}	6.8×10^{-7}	2.5×10^{-3}
14	7.49×10^{-11}	0.84	9.6×10^{-5}	8.4×10^{-5}	1.8×10^{-5}	6.4×10^{-3}
15	0	0.85	5.5×10^{-5}	5.0×10^{-5}	9.0×10^{-6}	5.9×10^{-3}
16	0	0.91	5.9×10^{-6}	6.4×10^{-6}	6.8×10^{-7}	3.3×10^{-3}
17	0	0.91	5.9×10^{-6}	6.4×10^{-6}	6.8×10^{-7}	3.3×10^{-3}
18	5.86×10^{-6}	0.84	1.7×10^{-5}	6.7×10^{-8}	6.7×10^{-8}	2.5×10^{-3}
19	0.99993	0	0	0	0	0

(a) RADTRAN 5 also models the fraction of the released particulate material that is small enough to be dispersible in prevailing wind conditions and the fraction that is respirable. For this analysis, these parameters were set to 1.0 (i.e., 100 percent dispersible and 100 percent respirable).

(b) Severity fractions are the conditional probabilities, given the occurrence of an accident, that the mechanical and thermal conditions experienced by a spent fuel shipping cask are within the conditions defined by the Severity Category. See Sprung et al. (2000) for detailed information about the derivation of these data. Generic steel-depleted uranium-steel cask designs were assumed for the severity fractions.

The severity categories and release fractions published by Sprung et al. (2000) were designed specifically to address accidents involving current generation LWR fuel and the current generation of spent fuel shipping casks. While some of the advanced reactor fuel designs are similar to current-generation reactor fuel designs (e.g., the ABWR, ESBWR, Surrogate AP1000, ACR-700, and IRIS), others are significantly different, including the GT-MHR and PBMR.

Extrapolating the current generation of LWR fuel and shipping casks to advanced LWR fuels and shipping casks is expected to be relatively straightforward because the fuel form, cladding, and physical and mechanical properties are similar. Furthermore, substantial experimental data exist to develop technically defensible release fractions for various radionuclide groups (e.g., gases, semi-volatiles such as cesium and ruthenium, and particulates). However, because detailed experimental studies of releases from GT-MHR and PBMR fuels have not been this approach is bounding. However, gas-cooled reactors operate at much higher temperatures than LWRs; thus, high-temperature conditions anticipated in transportation accident fires are expected to have less effect on radionuclide releases than they would for LWR fuels. Consequently, smaller release fractions are anticipated for advanced gas-cooled reactor fuels than for LWR fuels subjected to thermal transients.

For accidents that result in a release of radioactive material, RADTRAN 5 assumes the material is dispersed into the environment according to standard Gaussian diffusion models. The code allows the user to choose two different methods for modeling the atmospheric transport of radionuclides after a potential accident. The user can input either Pasquill atmospheric-stability category data or averaged time-integrated concentrations. In this Section H.2 analysis, the default standard cloud option (using time-integrated concentrations) was used.

RADTRAN 5 was used to calculate the population dose from the released radioactive material for four of five[(a)] possible exposure pathways:

- External dose from exposure to the passing cloud of radioactive material (cloudshine).

- External dose from radionuclides deposited on the ground by the passing plume (groundshine). The Section H.2 analysis included the radiation exposures from this pathway even though the area surrounding a potential accidental release would be evacuated and decontaminated, thus preventing long-term exposures from this pathway.

- Internal dose from inhalation of airborne radioactive contaminants (inhalation).

- Internal dose from radioactive materials that were deposited on the ground and then resuspended (resuspension). The Section H.2 analysis included the radiation exposures from this pathway even though evacuation and decontamination of the area surrounding a potential accidental release would prevent long-term exposures.

A sixth pathway, external doses arising from increased radiation fields surrounding a shipping cask with damaged shielding, was considered but not included in the analysis. It is possible that

(a) The internal dose from ingestion of contaminated food was not considered, as the staff assumed evacuation and subsequent interdiction of foodstuffs following a potential transportation accident.

shielding materials incorporated into the cask structures could become damaged as a result of an accident. For example, casks with lead shielding could undergo a slumping phenomenon in which impact or fire causes gaps to form in the lead. Radiation would penetrate through the gaps in the shielding at higher intensities, leading to higher radiation dose rates. These events, which are commonly referred to as "loss of shielding events," were not included in this assessment because their contribution to spent fuel transportation risks is much smaller than the dispersal accident risks.

Standard radionuclide uptake and dosimetry models are incorporated into RADTRAN 5. The computer code combines the accident consequences and frequencies of each severity category, sums up the severity categories, and then integrates across all the shipments. Accident-risk impacts are provided in the form of a collective population dose (person-rem over the entire shipping campaign).

The shipping distances and population distribution information for the routes used for the evaluation of the impacts of incident-free transportation (see Table H-6) were also used to calculate transportation impacts. Representative shipping casks described above were assumed.

Table H-13 presents unit (per MTU) accident risks associated with transportation of spent fuel from each potential ESP site to the proposed Yucca Mountain repository.

Projected annual accident risks, normalized to the WASH-1238 (AEC 1972) reference LWR net electrical generation (i.e., 880 MW(e)) are presented in Table H-13. As expected, accident risks are highest for the longest shipments. Also, consistent with past spent fuel transportation risk assessments, the routine impacts are several orders of magnitude greater than accident impacts.

Considering the small magnitude of the risks presented in Table H-12 and the conservative computational methods and data used to address uncertainties, the overall transportation accident risks associated with ABWR, ESBWR, Surrogate AP1000, GT-MHR, and PBMR spent fuel shipments are judged to be small. Although likely to also be small, accident risks associated with IRIS and ACR-700 spent fuel shipments could not be analyzed because of the lack of radionuclide source-term data. Additional analyses are necessary to quantify the impacts of IRIS and ACR-700 spent fuel shipments.

Table H-13. Unit Spent Fuel Transportation Accident Risks for Advanced Reactors

Site	Advanced Reactor Type			
	ABWR/ ESBWR	Surrogate AP1000	GT-MHR	PBMR
Population Dose, person-Sv/MTU[(a)]				
Braidwood[(b)]	1.0×10^{-7}	1.0×10^{-8}	1.5×10^{-8}	2.5×10^{-8}
Clinton	1.1×10^{-7}	1.0×10^{-8}	1.5×10^{-8}	2.6×10^{-8}
FitzPatrick	1.9×10^{-7}	1.7×10^{-8}	2.5×10^{-8}	4.3×10^{-8}
Grand Gulf[(c)]	2.0×10^{-7}	1.9×10^{-8}	2.8×10^{-8}	4.7×10^{-8}
North Anna	2.3×10^{-7}	2.1×10^{-8}	3.2×10^{-8}	5.4×10^{-8}
Pilgrim	4.0×10^{-7}	3.7×10^{-8}	5.5×10^{-8}	9.3×10^{-8}
Portsmouth	2.3×10^{-7}	2.1×10^{-8}	3.1×10^{-8}	5.2×10^{-8}
Quad Cities	1.0×10^{-7}	9.4×10^{-9}	1.4×10^{-8}	1.4×10^{-8}
Savannah River	2.3×10^{-7}	2.4×10^{-8}	3.6×10^{-8}	6.1×10^{-8}
Surry	2.4×10^{-7}	2.2×10^{-8}	3.3×10^{-8}	5.6×10^{-8}
Zion	1.5×10^{-7}	1.4×10^{-8}	2.1×10^{-8}	3.5×10^{-8}

(a) To convert to person-rem, multiply person-Sv by 100.
(b) Dresden and LaSalle can be assumed to be bounded by the Braidwood values because of the proximity of the sites.
(c) The River Bend alternative site can be assumed to bounded by the Grand Gulf values because of the proximity of the sites.

Table H-14 presents the environmental consequences of transportation accidents when shipping spent fuel from the proposed ESP sites and alternative sites to the proposed Yucca Mountain repository. The shipping distances and population distribution information for the routes were the same as those used for the normal “incident-free” conditions. The table presents estimates of population dose (person-Sv/reference reactor year) for several of the advanced reactor designs. These values are normalized to the WASH-1238 reference reactor (880-MW(e)) net electrical generation, 1100-MW(e) reactor operating at 80 percent capacity).

Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses below about 100 mSv (10,000 mrem) and low dose rates. However, radiation protection experts conservatively assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship

Table H-14. Annual Spent Fuel Transportation Accident Impacts for Advanced Reactors, Normalized to Reference LWR Net Electrical Generation

	Advanced Reactor Type			
	ABWR/ESBWR	**Surrogate AP1000**	**GT-MHR**	**PBMR**
MTU/reference reactor year	**20.3**	**19.7**	**6.0**	**5.8**
Population Dose, person-Sv per reference reactor year[(a)]				
Braidwood[(b)]	2.1×10^{-6}	2.0×10^{-7}	8.9×10^{-8}	1.5×10^{-7}
Clinton	2.3×10^{-5}	2.0×10^{-7}	9.1×10^{-8}	1.5×10^{-7}
FitzPatrick	3.8×10^{-6}	3.3×10^{-7}	1.5×10^{-7}	2.5×10^{-7}
Grand Gulf[(c)]	4.1×10^{-6}	3.7×10^{-7}	1.7×10^{-7}	2.7×10^{-7}
North Anna	4.7×10^{-6}	4.2×10^{-7}	1.9×10^{-7}	3.1×10^{-7}
Pilgrim	8.1×10^{-6}	7.2×10^{-7}	3.3×10^{-7}	5.4×10^{-7}
Portsmouth	4.6×10^{-6}	4.0×10^{-7}	1.8×10^{-7}	3.0×10^{-7}
Quad Cities	2.1×10^{-6}	1.8×10^{-7}	8.4×10^{-8}	8.1×10^{-8}
Savannah River	5.3×10^{-6}	4.7×10^{-7}	2.2×10^{-7}	3.5×10^{-7}
Surry	4.9×10^{-6}	4.3×10^{-7}	2.0×10^{-7}	3.2×10^{-7}
Zion	3.0×10^{-6}	2.7×10^{-7}	1.2×10^{-7}	2.0×10^{-7}

(a) Multiply person-Sv/reference reactor year by 100 to obtain doses in person-rem/reference reactor year.
(b) Dresden and LaSalle can be assumed to be bounded by the Braidwood values because of the proximity of the sites.
(c) The River Bend alternative site can be assumed to be bounded by the Grand Gulf values because of the proximity of the sites.

between radiation dose and detriments such as cancer induction. A recent report (National Research Council 2006), the BEIR VII report, supports the linear, no-threshold dose response theory. Simply put, the theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks.

Based on this model, the staff estimates the risk to the public from radiation exposure using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv [1,000,000 person-rem]) from ICRP Publication 60 (ICRP 1991). All the population doses presented in Table H-14 are less than 1.0×10^{-5} person-Sv (1.0×10^{-3} person-rem) per reference reactor year; therefore, the total detriment estimates associated with these population doses would all be less than 1.0×10^{-6} fatal cancers, nonfatal cancers, and severe hereditary effects per reference reactor year. These risks are quite small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from exposure to natural sources of radiation using the same risk model.

H.2.3 Shipment of Radioactive Waste

This section discusses the environmental effects of transporting radioactive waste from advanced reactor sites. The environmental conditions listed in 10 CFR 51.52 that apply to shipments of radioactive waste are as follows:

- Radioactive waste (except spent fuel) is packaged and in a solid form [51.52(a)(4)]

- Radioactive waste (except spent fuel) is shipped from the reactor by truck or rail [51.52(a)(5)].

INEEL (2003) indicates that all of the advanced reactors will transport their radioactive waste by truck. Furthermore, INEEL (2003) indicates that all of the advanced reactors plan to solidify and package their radioactive waste. In addition, all of the advanced reactors will be subject to NRC (10 CFR Part 71) and U.S. Department of Transportation regulations for the shipment of radioactive material (49 CFR Parts 171, 172, 173, 178).

Table S–4 also specifies the following conditions that apply to shipments of radioactive waste:

- Weight – less than 33,100 kg (73,000 lb) per truck or 100 tons per cask per rail car

- Traffic density – less than one truck shipment per day or three rail cars per month.

The advanced reactors are assumed to be capable of shipping their radioactive wastes in compliance with Federal or State weight restrictions. With respect to the traffic density, all of the advanced reactor vendors provided radioactive waste generation estimates. Table H-15 provides these estimates, in addition to the radioactive waste generation estimates for the reference LWR in WASH-1238 (AEC 1972).

As shown in the table, only the PBMR generates a larger volume of radioactive waste than the reference LWR in WASH-1238. However, the GT-MHR and PBMR information in INEEL (2003) assumed these advanced reactors would ship wastes using two different packaging systems: one that hauls 28 m^3/shipment (1000 ft^3 per shipment) and one that hauls 5.7 m^3/shipment (200 ft^3/per shipment). Under those conditions, the number of shipments of radioactive waste per year, normalized to 1100 MW(e) electric generation capacity, would be about six shipments/year per 1100 MW(e) (880 net MW(e)) for the GT-MHR and seven shipments/year per 1100 MW(e) for the PBMR. These estimates are well below the reference LWR (42 shipments per 1100 MW(e)). In any event, all the estimates are well below the one truck shipment per day condition given in 10 CFR 51.52, Table S–4. Doubling the shipment estimates to account for empty return shipments is still well below the one shipment per day condition.

Table H-15. Summary of Radioactive Waste Shipments for Advanced Reactors

Reactor Type	INEEL (2003) Waste Generation Information	Annual Waste Volume, m^3/yr per Unit	Electrical Output, MW(e) per Unit	Normalized Rate, m^3/1100 MW(e) Reactor (880 MW(e) Net)[(a)]	Shipments/ 1100 MW(e) (880 MW(e) Net) Electrical Output[(b)]
Reference LWR (WASH-1238)	100 m^3/yr per unit	108	1100	108	46
ABWR	100 m^3/yr per unit	100	1500[(c)]	62	27
ESBWR	100 m^3/yr per unit	100	1500[(c)]	62	27
Surrogate AP1000	55 m^3/yr per unit	56	1150[(c)]	45	20
ACR-700	47.5 m^3/yr per unit	95	1462[(d)]	64	28
IRIS	25 m^3/yr per unit	74 (3 units)	1005[(e)]	67	29
GT-MHR	98 m^3/yr (4-unit plant)	98 (4 units)	1140[(f)]	86	37[(h)]
PBMR	100 drums/yr per unit	168 (8 units)	1320[(g)]	118	51[(h)]

(a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are given in Table 6-3 for each reactor type. All are normalized to 880 MW(e) net electrical output (1100-MW(e) plant with an 80 percent capacity factor).
(b) The number of shipments per 1100 MW(e) was calculated assuming the WASH-1238 average waste shipment capacity of 2.34 m^3 per shipment (108 m^3/yr divided by 46 shipments).
(c) The ABWR and ESBWR units include one reactor at 1500 MW(e) and the surrogate AP1000 site includes one reactor at 1150 MW(e).
(d) The ACR-700 unit includes two reactors at 731 MW(e) per reactor.
(e) The IRIS unit includes three reactors at 335 MW(e) per reactor.
(f) The GT-MHR unit includes four reactors at 285 MW(e) per reactor.
(g) The PBMR unit includes eight reactors at 165 MW(e) per reactor.
(h) INEEL (2003) states that 90 percent of the waste could be shipped on trucks carrying 28 m^3 (1000 ft^3) of waste and the remaining 10 percent in shipments carrying 5.7 m^3 (200 ft^3) of radioactive waste. This would result in five to six shipments per year after normalization to the reference LWR electrical output.
Conversions: 1 m^3 = 35.31 ft^3. Drum volume = 210 liters (0.21 m^3).

H.3 Support Information for Radiological Dose Assessment

The staff performed an independent assessment of the radiological impacts of normal operation for a new nuclear unit at the Grand Gulf ESP site. Results of this assessment are presented in this appendix and are compared to SERI's results in Section 5.9, "Radiological Impacts of Normal Operation," of Revision 2 of the Environmental Review in SERI's application

(SERI 2005a). This section contains information on (1) dose estimates to the public from liquid effluents, (2) dose estimates to the public from gaseous effluents, and (3) dose estimates to the biota from both liquid and gaseous effluents.

For comparative purposes with SERI's estimates, all doses and amounts of radioactive material are reported in millirem (mrem) and curies (Ci), respectively.

H.3.1 Dose Estimates to the Public from Liquid Effluents

The staff used the LADTAP II code (Strenge et al. 1986) and input parameters supplied by SERI in its environmental report, Revision 2 (SERI 2005a) to estimate doses to the general population and the maximally exposed individual[a] from the liquid effluent pathway

H.3.1.1 Scope

The important pathways for determining the dose to the population and to the maximally exposed individual from liquid effluents include:

- Eating fish or invertebrates that are caught in the Mississippi River near the point of discharge. The population doses are based on the commercial fish and invertebrate catches taken from the Grand Gulf environmental report (MP&L 1973). The annual consumption rate of fish and shellfish by the maximally exposed individual is taken from estimates provided in Regulatory Guide 1.109 (NRC 1977b)

- External exposure from the surface of contaminated water or from shoreline sediment as a result of using the shoreline for activities such as sunbathing or fishing

There are only three public water supply systems in the state of Mississippi that use surface water as a source, and none of these are located within 80 km (50 mi) of the Grand Gulf ESP site. There are no downstream intakes that use the Mississippi River as a potable water supply within 160 km (100 mi) of the Grand Gulf ESP site. For this reason, ingestion of water is not considered as a pathway.

Swimming and recreational boating in the Mississippi River near the GGNS site is very limited, and it was assumed for this analysis that no swimming or recreational boating occurs.

(a) The maximally exposed individual probably does not really exist. It is an imaginary person used to ensure that the dose criterial set forth in NRC regulations are met by nuclear power facilities. At this facility, the maximally exposed individual is assumed to eat fish and shellfish caught near the point of discharge and use the shoreline for activities such as sunbathing or fishing.

Doses to the maximally exposed individual were calculated for the following:

- Total body - Dose was the total for all pathways (i.e., fish and invertebrate consumption and shoreline usage) with the highest value for either the adult, teen, child, or infant compared to the design objective of 0.03 mSv/yr (3 mrem/yr) per reactor in Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix I.

- Organ dose - Dose was the total for each organ for all pathways (i.e., fish and invertebrate consumption and shoreline usage) with the highest value for either the adult, teen, child, or infant compared to the design objective of 0.1 mSv/yr (10 mrem/yr) per reactor in 10 CFR Part 50, Appendix I.

The NRC staff reviewed the input parameters used by SERI for appropriateness. Default values for input parameters from Regulatory Guide 1.109 were used when site-specific parameters were not available.

H.3.1.2 Resources Used

The staff used a personal computer version of the LADTAP II code entitled NRCDOSE Version 2.3.5 (Bland 2000), obtained through the Oak Ridge Radiation Safety Information Computational Center (RSICC) to calculate doses to the public from liquid effluents.

H.3.1.3 Input Parameters

Table H-16 provides a listing of the major parameters used in calculating dose to the public from liquid effluent releases during normal operation. The values used by SERI and the staff for each parameter are listed along with comments regarding the appropriateness of the value. All of the input parameters were similar and appropriate.

Table H-16. Parameters Used in Calculating Dose to the Public from Liquid Effluents

Parameter	SERI Value		Staff Value		Comments (Appropriateness of Value)
Source term (Ci/yr)	Table 3.0-8 of SERI (2005a), modified as discussed in "Comments" column		Table 3.0-8 of SERI (2005a), modified as discussed in "Comments" column		
	Iodine-131	2.826×10^{-2}	Iodine-131	2.83×10^{-2}	The staff's values were rounded to three significant digits.
	Iodine-132	5.200×10^{-3}	Iodine-132	5.20×10^{-3}	
	Iodine-133	2.000×10^{-2}	Iodine-133	2.00×10^{-2}	
	Iodine-134	3.400×10^{-3}	Iodine-134	3.40×10^{-3}	
	Iodine-135	1.503×10^{-2}	Iodine-135	1.50×10^{-2}	
	Tritium	$6.200 \times 10^{+3}$	Tritium	$6.20 \times 10^{+3}$	Rhodium-106 (1.47×10^{-1} curies), Rhodium-103m (9.86×10^{-3} curies), Silver-110 (2.80×10^{-4} curies), Barium-137m (2.49×10^{-2} curies), were not included in the calculation because they are not accepted by the LADTAP II code. Their contribution to the dose is relatively small.
	Carbon-14	8.800×10^{-4}	Carbon-14	8.80×10^{-4}	
	Sodium-24	5.622×10^{-3}	Sodium-24	5.62×10^{-3}	
	Phosphorus-32	3.600×10^{-4}	Phosphorus-32	3.60×10^{-4}	
	Chromium-51	1.541×10^{-2}	Chromium-51	1.54×10^{-2}	
	Manganese-54	5.200×10^{-3}	Manganese-54	5.20×10^{-3}	
	Manganese-56	7.622×10^{-3}	Manganese-56	7.62×10^{-3}	
	Cobalt-57	1.438×10^{-4}	Cobalt-57	1.44×10^{-4}	
	Cobalt-58	6.720×10^{-3}	Cobalt-58	6.72×10^{-3}	
	Cobalt-60	1.822×10^{-2}	Cobalt-60	1.82×10^{-2}	
	Iron-55	1.162×10^{-2}	Iron-55	1.16×10^{-2}	
	Iron-59	4.000×10^{-4}	Iron-59	4.00×10^{-4}	
	Nickel-63	2.800×10^{-4}	Nickel-63	2.80×10^{-4}	
	Copper-64	1.503×10^{-2}	Copper-64	1.50×10^{-2}	
	Zinc-65	8.200×10^{-4}	Zinc-65	8.20×10^{-4}	
	Bromine-84	4.000×10^{-5}	Bromine-84	4.00×10^{-5}	
	Rubidium-88	5.400×10^{-4}	Rubidium-88	5.40×10^{-4}	
	Rubidium-89	8.811×10^{-5}	Rubidium-89	8.81×10^{-5}	
	Strontium-89	2.200×10^{-4}	Strontium-89	2.20×10^{-4}	
	Strontium-90	7.027×10^{-5}	Strontium-90	7.03×10^{-5}	
	Yttrium-90	6.216×10^{-6}	Yttrium-90	6.22×10^{-6}	
	Strontium-91	1.800×10^{-3}	Srtrontium91	1.80×10^{-3}	
	Yttrium-91	2.200×10^{-4}	Yttrium-91	2.20×10^{-4}	
	Yttrium-91m	2.000×10^{-5}	Yttrium-91m	2.00×10^{-5}	
	Strontium-92	1.600×10^{-3}	Strontium-92	1.60×10^{-3}	
	Yttrium-92	1.200×10^{-3}	Yttrium-92	1.20×10^{-3}	
	Yttrium-93	1.800×10^{-3}	Yttrium-93	1.80×10^{-3}	
	Zirconium-95	2.080×10^{-3}	Zirconium-95	2.08×10^{-3}	
	Niobium-95	3.820×10^{-3}	Niobium-95	3.82×10^{-3}	
	Molybdenum-99	1.659×10^{-3}	Molybdenum-99	1.66×10^{-3}	
	Technetium-99m	1.600×10^{-3}	Technetium-99m	1.60×10^{-3}	
	Ruthenium-103	9.860×10^{-3}	Ruthenium-103	9.86×10^{-3}	
	Ruthenium-106	1.470×10^{-1}	Ruthenium-106	1.47×10^{-1}	
	Silver-110m	2.100×10^{-3}	Silver-110m	2.10×10^{-3}	

Table H-16. (contd)

Parameter	SERI Value		Staff Value		Comments (Appropriateness of Value)
	Antimony-124	1.358×10^{-3}	Antimony-124	1.35×10^{-3}	
	Tellurium-129	3.000×10^{-4}	Tellurium-129	3.00×10^{-4}	
	Tellurium-129m	2.400×10^{-4}	Tellurium-129m	2.40×10^{-4}	
	Tellurium-131	6.000×10^{-5}	Tellurium-131	6.00×10^{-5}	
	Tellurium-131m	1.800×10^{-4}	Tellurium-131m	1.80×10^{-4}	
	Tellurium-132	4.800×10^{-4}	Tellurium-132	4.80×10^{-4}	
	Cesium-134	1.986×10^{-2}	Cesium-134	1.99×10^{-2}	
	Cesium-136	1.260×10^{-3}	Cesium-136	1.26×10^{-3}	
	Cesium-137	2.664×10^{-2}	Cesium-137	2.66×10^{-2}	
	Cesium-138	3.800×10^{-4}	Cesium-138	3.80×10^{-4}	
	Barium-140	1.104×10^{-2}	Barium-140	1.10×10^{-2}	
	Lanthanum-140	1.486×10^{-2}	Barium-140	1.49×10^{-2}	
	Cerium-141	2.400×10^{-4}	Cerium-141	2.40×10^{-4}	
	Cerium-143	3.800×10^{-4}	Cerium-143	3.80×10^{-4}	
	Cerium-144	6.320×10^{-3}	Cerium-144	6.32×10^{-3}	
	Praseodymium-143	2.600×10^{-4}	Praseodymium-143	2.60×10^{-4}	
	Praseodymium-144	6.320×10^{-3}	Praseodymium-144	6.32×10^{-3}	
	Tungsten-187	2.600×10^{-4}	Tungsten-187	2.60×10^{-4}	
	Neptunium-239	6.216×10^{-3}	Neptumium-239	6.22×10^{-3}	
Discharge flow rate cfs (gpm)	0.078 (35)		0.078 (35)		Site-specific value from Table 3.0-1 (SERI 2005a)
Source term multiplier	1		1		Site specific value from SERI (2005b)
Site type	Fresh water		Fresh water		Site specific value from SERI (2005b)
Reconcentration model	No internal reconcentration model employed		No internal reconcentration model employed		
80-kilometer (50-mile) population	$3.95 \times 10^{+5}$		$3.95 \times 10^{+5}$		Value from Tables 2.5-1 and 2.5-6 (SERI 2005a)
Shore width factor	0.2		0.2		Site-specific value based on Regulatory Guide 1.109 (NRC 1977b)

Table H-16. (contd)

Parameter	SERI Value	Staff Value	Comments (Appropriateness of Value)
Dilution factors for aquatic food and shoreline	730	730	Based on a cooling tower blowdown rate of 808 L/s (12,800 gpm) (Table 5.4-1 of SERI 2005a) and a dilution factor of 2 in the Mississippi River (SERI 2006).
Consumption and usage factors for adults, teens, children, and infants	Values from Table 5.4-2 of environmental report (SERI 2005a)	Values from Table 5.4-2 of environmental report (SERI 2005a)	Default values from Regulatory Guide 1.109

H.3.1.4 Comparison of Results

Table H-17 compares the results obtained by SERI for the maximum individual and total population dose with those obtained by calculations performed by the staff. The dose results are essentially the same.

Table H-17. Comparison of Dose Estimates to the Public from Liquid Effluent Release per Unit

Type of Dose	SERI's Environmental Report (SERI 2005a)	Staff's Calculation	Percent Difference
Maximum Individual Dose (mrem/yr)[(a)]			
Total Body (mrem/yr)[(b)]	2.17	2.17	0
Organ Dose (bone)[(c)] (mrem/yr)	4.10	4.09	<1
Total Population Dose (person-rem/yr)[(d)]			
Total Body	2.06	2.06	0
Maximum Organ (liver)	3.32	3.32	0

(a) mrem = millirem; divide mrem/yr by 100 to obtain millisievert/yr
(b) An adult was found to receive the maximum individual total body dose.
(c) A child was found to receive the maximum individual organ dose.
(d) Divide man-rem/yr by 100 to obtain person-sievert/yr.

H.3.2 Dose Estimates to the Public from Gaseous Effluents

The staff used the GASPAR II code (Strenge et al. 1987) and input parameters supplied by SERI in its environmental report, Revision 2 (SERI 2005a) to estimate doses to the general population within an 80-km (50-mi) radius of the Grand Gulf ESP site and to the maximally exposed individual from the gaseous effluent pathways.

H.3.2.1 Scope

The staff and SERI calculated annual radiation exposures for the population within a 80-km (50-mi) radius of the site and for hypothetical individuals of various ages using the GASPAR II code and assuming the following pathways:

- Direct radiation from immersion in the gaseous effluent cloud and from particulates deposited on the ground
- Inhalation of gases and particulates
- Ingestion of milk contaminated through the grass-cow-milk pathway
- Ingestion of vegetables contaminated by particulates
- Ingestion of meat from animals grazing on contaminated pasture.

Three types of doses were calculated by the staff and compared with SERI's calculations.

- Doses to an individual located at the exclusion area boundary of 0.93 km (0.58 mi) north of the site as a result of gamma air dose, beta air dose, total body dose and skin dose
- Doses to hypothetical individuals (maximally exposed individual) of various ages that are exposed to gaseous radioactive effluents via the pathways listed above
- Doses to the population residing within an 80-km (50-mi) radius of the site.

The NRC staff reviewed the input parameters used by SERI for appropriateness. Default values for input parameters from Regulatory Guide 1.109 (NRC1977b) were used when site-specific input parameters were not available. The staff concluded that all the input parameters used by SERI were appropriate. These parameters were used by the staff in its independent calculations.

H.3.2.2 Resources Used

The staff used a personal computer version of GASPAR II code entitled NRCDOSE, Version 2.3.5 (Bland 2000), obtained through the Oak Ridge RSICC to calculate doses to the public from gaseous effluents.

H.3.2.3 Input Parameters

Table H-18 provides a list of the major parameters used in calculating dose to the public from gaseous effluent releases during normal operation. The values used by SERI and the staff for each parameter are listed along with comments regarding the appropriateness of the value.

Table H-18. Parameters Used in Calculating Dose to the Public from Gaseous Effluent Releases

Parameter	SERI Value (Table 3.0-7 in SERI 2005a)		Staff Value		Comments (Appropriateness of Value)
Source term for calculating dose to the maximally exposed individual (curies/year) and population within 50-mile radius	Krypton-83m	1.68×10^{-3}	Krypton-83m	1.68×10^{-3}	The source term is the bounding plant paramenter envelope. The values are appropriate.
	Krypton-85m	$7.20 \times 10^{+1}$	Krypton-85m	$7.20 \times 10^{+1}$	
	Krypton-85	$8.20 \times 10^{+3}$	Krypton-85	$8.20 \times 10^{+3}$	
	Krypton-87	$5.03 \times 10^{+1}$	Krypton-87	$5.03 \times 10^{+1}$	
	Krypton-88	$9.20 \times 10^{+1}$	Krypton-88	$9.20 \times 10^{+1}$	
	Krypton-89	$4.81 \times 10^{+2}$	Krypton-89	$4.81 \times 10^{+2}$	
	Xenon-131m	$3.60 \times 10^{+3}$	Xenon-131m	$3.60 \times 10^{+3}$	Krypton-90 (6.49×10^{-4} curies), Xenon-139 (8.11×10^{-4} curies), Ruthenium-103m (2.22×10^{-4} curies) Rhodium-106 (3.78×10^{-5} curies), were not included in the calculation because they are not accepted by the GASPAR code. Their contribution to the total dose is small.
	Xenon-133m	$1.74 \times 10^{+2}$	Xenon-133m	$1.74 \times 10^{+2}$	
	Xenon-133	$9.20 \times 10^{+3}$	Xenon-133	$9.20 \times 10^{+3}$	
	Xenon-135m	$8.11 \times 10^{+2}$	Xenon-135m	$8.11 \times 10^{+2}$	
	Xenon-135	$9.19 \times 10^{+2}$	Xenon-135	$9.19 \times 10^{+2}$	
	Xenon-137	$1.03 \times 10^{+3}$	Xenon-137	$1.03 \times 10^{+3}$	
	Xenon-138	$8.65 \times 10^{+2}$	Xenon-138	$8.65 \times 10^{+2}$	
	Iodine-131	5.19×10^{-1}	Iodine-131	5.19×10^{-1}	
	Iodine-132	$4.38 \times 10^{+0}$	Iodine-132	$4.38 \times 10^{+0}$	
	Iodine-133	$3.41 \times 10^{+0}$	Iodine-133	$3.41 \times 10^{+0}$	
	Iodine-134	$7.57 \times 10^{+0}$	Iodine-134	$7.57 \times 10^{+0}$	
	Iodine-135	$4.81 \times 10^{+0}$	Iodine-135	$4.81 \times 10^{+0}$	
	Carbon-14	$2.19 \times 10^{+1}$	Carbon-14	$2.19 \times 10^{+1}$	
	Tritium	$7.06 \times 10^{+3}$	Tritium	$7.06 \times 10^{+3}$	
	Sodium-24	8.11×10^{-3}	Sodium-24	8.11×10^{-3}	
	Phosphorus-32	1.84×10^{-3}	Phosphorus-32	1.84×10^{-3}	
	Argon-41	$1.02 \times 10^{+2}$	Argon-41	$1.02 \times 10^{+2}$	
	Chromium-51	7.03×10^{-2}	Chromium-51	7.03×10^{-2}	
	Manganese-54	1.08×10^{-2}	Manganese-54	1.08×10^{-2}	
	Manganese-56	7.03×10^{-3}	Manganese-56	7.03×10^{-3}	

Table H-18. (contd)

Parameter	SERI Value (Table 3.0-7 in SERI 2005a)		Staff Value		Comments (Appropriateness of Value)
	Iron-55	1.30×10^{-2}	Iron-55	1.30×10^{-2}	
	Cobalt-57	2.46×10^{-5}	Cobalt-57	2.46×10^{-5}	
	Cobalt-58	6.90×10^{-2}	Cobalt-58	6.90×10^{-2}	
	Iron-59	1.62×10^{-3}	Iron-59	1.62×10^{-3}	
	Cobalt-60	2.61×10^{-2}	Cobalt-60	2.61×10^{-2}	
	Nickel-63	1.30×10^{-5}	Nickel-63	1.30×10^{-5}	
	Copper-64	2.00×10^{-2}	Copper-64	2.00×10^{-2}	
	Zinc-65	2.22×10^{-2}	Zinc-65	2.22×10^{-2}	
	Rubidium-89	8.65×10^{-5}	Rubidium-89	8.65×10^{-5}	
	Strontium-89	1.14×10^{-2}	Strontium-89	1.14×10^{-2}	
	Strontium-90	3.60×10^{-3}	Strontium-90	3.60×10^{-3}	
	Yttrium-90	9.19×10^{-5}	Yttrium-90	9.19×10^{-5}	
	Strontium-91	2.00×10^{-3}	Strontium-91	2.00×10^{-3}	
	Strontium-92	1.57×10^{-3}	Strontium-92	1.57×10^{-3}	
	Yttrium-91	4.81×10^{-4}	Yttrium-91	4.81×10^{-4}	
	Yttrium-92	1.24×10^{-3}	Yttrium-92	1.24×10^{-3}	
	Yttrium-93	2.22×10^{-3}	Yttrium-93	2.22×10^{-3}	
	Zirconium-95	3.19×10^{-3}	Zirconium-95	3.19×10^{-3}	
	Niobium-95	1.68×10^{-2}	Niobium-95	1.68×10^{-2}	
	Molybdenum-99	1.19×10^{-1}	Molybdenum-99	1.19×10^{-1}	
	Technetium-99m	5.95×10^{-4}	Technetium-99m	5.95×10^{-4}	
	Ruthenium-103	7.03×10^{-3}	Ruthenium-103	7.03×10^{-3}	
	Ruthenium-106	2.34×10^{-4}	Ruthenium-106	2.34×10^{-4}	
	Silver-110m	4.00×10^{-6}	Silver-110m	4.00×10^{-6}	
	Antimony-124	3.62×10^{-4}	Antimony-124	3.62×10^{-4}	
	Antimony-125	1.83×10^{-4}	Antimony-125	1.83×10^{-4}	
	Tellurium-129m	4.38×10^{-4}	Tellurium-129m	4.38×10^{-4}	
	Tellurium-131m	1.51×10^{-4}	Tellurium-131m	1.51×10^{-4}	
	Tellurium-132	3.78×10^{-5}	Tellurium-132	3.78×10^{-5}	
	Cesium-134	1.24×10^{-2}	Cesium-134	1.24×10^{-2}	
	Cesium-136	1.19×10^{-3}	Cesium-136	1.19×10^{-3}	
	Cesium-137	1.89×10^{-2}	Cesium-137	1.89×10^{-2}	
	Cesium-138	3.41×10^{-4}	Cesium-138	3.41×10^{-4}	
	Barium-140	5.41×10^{-2}	Barium-140	5.41×10^{-2}	
	Lanthanum-140	3.62×10^{-3}	Lanthanum-140	3.62×10^{-3}	
	Cerium-141	1.84×10^{-2}	Cerium-141	1.84×10^{-2}	
	Cerium-144	3.78×10^{-5}	Cerium-144	3.78×10^{-5}	
	Praseodymium-144	3.78×10^{-5}	Praseodymium-144	3.78×10^{-5}	
	Tungsten-187	3.78×10^{-4}	Tungsten-187	3.78×10^{-4}	
	Neptunium-239	2.38×10^{-2}	Neptunium-239	2.38×10^{-2}	
Population Distribution	Used data from SERI's supporting documentation (equivalent to data found in Tables 2.5-1 and 2.5-6 of SERI (2005a) for the year 2070)		Used data from SERI's supporting documentation (equivalent to data found in Tables 2.5-1 and 2.5-6 of SERI (2005a) for the year 2070)		Site-specific data - appropriate for use
Atmospheric dispersion factors	Used data from SERI's supporting documentation (equivalent to		Used data from SERI's supporting documentation (equivalent to		Site-specific data - appropriate for use

Table H-18. (contd)

Parameter	SERI Value (Table 3.0-7 in SERI 2005a)	Staff Value	Comments (Appropriateness of Value)
(sec/m^3)	Table 2.7-118 of SERI (2005a))	Table 2.7-118 of SERI (2005a))	
Ground deposition factors (m^{-2})	Used data from SERI's supporting documentation (equivalent to Table 2.7-120 of SERI (2005a))	Used data from SERI's supporting documentation (equivalent to Table 2.7-120 of SERI (2005a))	Site-specific data - appropriate for use
Milk production rate within 80 km (50 mi) (L/yr)	Used data from SERI's supporting documentation (equivalent to Table 5.4-5 of SERI (2005a))	Used data from SERI's supporting documentation (equivalent to Table 5.4-5 of SERI (2005a))	Site-specific data - appropriate for use
Meat production rate within 80 km (50 mi) (kg/yr)	Used data from SERI's supporting documentation (equivalent to Table 5.4-6 of SERI (2005a))	Used data from SERI's supporting documentation (equivalent to Table 5.4-6 of SERI (2005a))	Site-specific data - appropriate for use
Vegetable production rate within 80 km (50 mi) (kg/yr)	Used data from SERI's supporting documentation (equivalent to Table 5.4-7 of SERI (2005a))	Used data from SERI's supporting documentation (equivalent to Table 5.4-7 of SERI (2005a))	Site-specific data - appropriate for use
Pathway receptor locations (direction, distance and atmospheric dispersion factors) Nearest site boundary Nearest vegetable garden Nearest home Nearest milk cow Nearest meat cow	Used data from SERI's supporting documentation (equivalent to Table 2.7-117 of SERI (2005a))	Used data from SERI's supporting documentation (equivalent to Table 2.7-117 of SERI (2005a))	Site-specific data - appropriate for use
Consumption factors for leafy vegetables, meat, milk, and vegetable/fruit	Table 5.4-4 of SERI (2005a)	Table 5.4-4 of SERI (2005a)	Appropriate for use - NRC 1977b
Fraction of year that leafy green vegetables are grown	1	1	Appropriate for use
Fraction of year that cows are on pasture	1	1	Appropriate for use
Fraction of the max individual's vegetable intake from their own garden	0.76	0.76	Appropriate for use

Table H-18. (contd)

Parameter	SERI Value (Table 3.0-7 in SERI 2005a)	Staff Value	Comments (Appropriateness of Value)
Fraction of milk cow intake that is from pasture while on pasture	1	1	Appropriate for use
Average absolute humidity over the growing season	8	8	Appropriate for use - Default value of GASPAR II code - appropriate for use
Fraction of year goats are on pasture	1	1	Site-specific data - appropriate for use
Fraction of goat intake that is from pasture while on pasture	1	1	Site-specific data - appropriate for use
Fraction of year beef-cattle are on pasture	1	1	Site-specific data - appropriate for use
Fraction of beef-cattle intake that is from pasture while on pasture	1	1	Site-specific data - appropriate for use

H.3.2.4 Comparison of Dose Estimates to the Public from Gaseous Effluent Releases

Table H-19 compares results obtained by SERI with those performed by the staff for doses to the maximally exposed individual, primarily at the exclusion area boundary. Doses calculated were similar.

Table H-19. Comparison of Dose Estimates to the Maximally Exposed Individual from Gaseous Pathway Releases

Type of Dose	SERI's Environmental Report (SERI 2005a)	Staff's Calculation	Percent Difference
Gamma air dose at exclusion area boundary (mrad)[(a)]	1.80	1.80	0
Beta air dose at exclusion area boundary (mrad)[(a)]	3.48	3.48	0
Total body dose at exclusion area boundary (plume, ground, and inhalation) - (Teen) (mrem)[(b)]	1.62	1.69	4.3
Skin dose at exclusion area boundary - (Teen) (mrem)[(b)]	4.42	4.42	0
Vegetable consumption at nearest garden (Child, thyroid) (mrem)[(b)]	6.70	6.70	0

(a) mrad = millirad; divide mrad by 100 to obtain milligray/yr.
(b) mrem = millirem; divide mrem by 100 to obtain millisievert/yr.

Table H-20 provides the doses to the maximally exposed individual calculated by SERI and the staff. Doses to the maximally exposed individual were calculated at the nearest residence, nearest garden, nearest site boundary, nearest meat cow, and nearest milk cow. The doses calculated by the NRC staff were the same as those calculated by SERI. Thus, only one number is given for each entry in the table.

Table H-20. SERI (2005a) and Staff Dose Estimates to the Maximally Exposed Individual from Gaseous Effluent Releases from Operation of One New Nuclear Unit

Location	Pathway	Total Body Dose (mrem/yr)[a]	Skin Dose (mrem/yr)[a][b]	Thyroid Dose (mrem/yr)[a]
Nearest Residence[c] (NNE, 1.02 km (0.64 mi))	Plume Exposure	0.63	2.09	0.63
	Inhalation			
	Adult	0.171	-	0.69
	Teen	0.173	-	0.85
	Child	0.153	-	0.995
	Infant	0.088	-	0.855
Nearest Garden[c] (ENE, 1.01 km (0.63 mi))	Vegetable Consumption			
	Adult	0.387	-	2.87
	Teen	0.491	-	0.36
	Child	0.901	-	0.67
Nearest Site Boundary[d] (N, 0.93 km (0.58 mi))	Plume Exposure	1.18	3.88	1.18
	Inhalation		-	
	Adult	0.318	-	1.28
	Teen	0.321	-	1.58
	Child	0.285	-	1.84
	Infant	0.164	-	1.58
Nearest Milk Cow[c] (S SW 16 km (10 mi))	Cow Milk		-	
	Adult	0.00565	-	0.055
	Teen	0.00833	-	0.0865
	Child	0.0159	-	0.172
	Infant	0.0287	-	0.409

Table H-20. (contd)

Location	Pathway	Total Body Dose (mrem/yr)[a]	Skin Dose (mrem/yr)[a][b]	Thyroid Dose (mrem/yr)[a]
Nearest Meat Cow[c] (S, 6.4 km (4.0 mi))	Meat Consumption			
	Adult	0.00653	-	0.0144
	Teen	0.00472	-	0.0104
	Child	0.00758	-	0.0163

(a) mrem = milirem; divide mrem/yr by 100 to obtain millisievert/yr.
(b) Skin dose is only applicable to plume exposure.
(c) "Nearest" refers to the location at which the highest radiation dose to an individual from the applicable pathways has been estimated.
(d) "Nearest" refers to that site boundary location at which the highest radiation doses from gaseous emissions have been estimated to occur.

H.3.2.5 Comparison of Results - Population Doses

Table H-21 compares the SERI population dose estimates taken from Table 5.4-13 of SERI (2005a) with the staff's estimate. Calculated doses are the same.

Table H-21. Comparison of Population Doses from Gaseous Effluent Releases

Pathway	SERI's Environmental Report (SERI 2005a)	Staff's Calculation	Percent Difference
	Total Body (person-rem/yr)[a]		
Plume	0.157	0.157	0
Ground	0.0546	0.0546	0
Inhalation	0.418	0.418	0
Vegetable ingestion	0.152	0.152	0
Cow-milk ingestion	0.215	0.215	0
Meat ingestion	0.184	0.184	0
Total	1.18	1.18	0
	Thyroid (Worst Case Organ) (person-rem/yr)[a]		
Plume	0.157	0.157	0
Ground	0.0546	0.0546	0
Inhalation	1.23	1.23	0
Vegetable ingestion	0.154	0.154	0
Cow-milk ingestion	0.89	0.890	0
Meat ingestion	0.248	0.248	0
Total	2.73	2.73	0

(a) Divide person-rem/yr by 100 to obtain person-sievert/yr.

H.3.3 Dose Estimates to the Biota from Liquid and Gaseous Effluents

To estimate doses to the biota from the liquid and gaseous effluent pathways, the staff used the LADTAP II code (Strenge et al. 1986) and the GASPAR II code (Strenge et al. 1987) and input parameters supplied by SERI as part of its environmental report (SERI 2005a).

H.3.3.1 Scope

Doses from the liquid pathways to both terrestrial and aquatic biota were calculated using the LADTAP II code. Aquatic biota include fish, invertebrates, and algae. Terrestrial biota include muskrat, raccoon, heron, and duck. The LADTAP II code calculates the biota dose from the liquid effluent pathway by calculating an internal dose component and an external dose component and summing them for a total dose. The NRC staff reviewed the input parameters used by SERI for appropriateness. Default values from Regulatory Guide 1.109 (NRC 1977b) were used when input parameters were not available. The staff used the same parameters in its independent calculations using LADTAP.

Terrestrial biota could also be exposed via the gaseous effluent pathway. An estimate of these values was made by using the dose from exposure to the ground and multiplying it by a factor that adjusts for the size of the animal and their distance from the ground. This is added to the dose from the plume to obtain the external dose. Internal dose to terrestrial biota is based on the total body inhalation dose for the maximally exposed individual (infant) at the site boundary calculated by GASPAR II. The total body inhalation dose (rather than organ specific doses) is used since the biota doses are assessed on a total body basis.

H.3.3.2 Resources Used

To calculate the doses to the public from liquid releases, the staff used a computer code entitled, NRCDOSE, version 2.3.5 (Bland 2000) which is a version of the LADTAP II code and the GASPAR II code, obtained through the Oak Ridge RSICC.

H.3.3.3 Input Parameters

The LADTAP II parameters are specified in Table H-16 and include the source term, discharge flow rate, reconcentration model, effluent discharge rate to the Mississippi River, impoundment total volume, and shore width factor. Parameters unique to the biota dose calculation were taken from Table 5.4-14 (terrestrial biota parameters including food intake, body mass and effective body radius) and Table 5.4-15 of the environmental report (SERI 2005a) (shoreline exposure and swimming exposure estimates). These parameters were default values used in the LADTAP II code (Strenge et al. 1986) and are appropriate values to use in calculating biota dose.

H.3.3.4 Comparison of Results

Table H-22 compares the dose results obtained by SERI (2005a, Table 5.4-16) with those performed by the staff for liquid effluents. The dose estimates were the same.

Table H-22. Comparison of Dose Estimates to Biota from Liquid Effluents

Biota	Type of Dose	SERI's Environmental Report (SERI 2005a) (mrad/yr)[(a)]	Staff's Calculation (mrad/yr)[(a)]	Percent Difference
Fish	Internal	14.2	14.2	0
	External	11.2	11.2	0
Invertebrates	Internal	143	143	0
	External	22.3	22.3	0
Algae	Internal	148	148	0
	External	0.05	0.05	0
Muskrat	Internal	73.8	73.8	0
	External	7.45	7.45	0
Raccoon	Internal	13.4	13.4	0
	External	5.57	5.57	0
Heron	Internal	186	186	0
	External	7.44	7.44	0
Duck	Internal	69.9	69.9	0
	External	11.2	11.2	0

(a) mrad = millirad; divide mrad/yr by 100 to obtain milligray/yr.

Table H-23 compares the dose results obtained by SERI (2005a, Table 5.4-16) with those performed by the staff for gaseous effluents. These dose estimates were similar.

Table H-23. Comparison of Dose Estimates to Biota from Gaseous Effluents

Biota	Type of Dose	SERI's Environmental Report (SERI 2005a) (mrad/yr)[(a)]	Staff's Calculation (mrad/yr)[(a)]	Percent Difference
Muskrat	Internal	0.164	0.164	0
	External	2.03	2.02	< 1
Raccoon	Internal	0.164	0.164	0
	External	1.82	1.81	< 1
Heron	Internal	0.164	0.164	0
	External	1.69	1.68	<1
Duck	Internal	0.164	0.164	0
	External	2.14	2.13	< 1

(a) mrad = millirad; divide mrad/yr by 100 to obtain milligray/yr.

H.4 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.”

10 CFR Part 71. Code of Federal Regulations,. Title 10, *Energy*, “Packaging and Transportation of Radioactive Material.”

49 CFR Part 171. Code of Federal Regulations, Title 49, *Transportation*, Part 171, “General Information, Regulations, and Definitions.”

49 CFR Part 172. Code of Federal Regulations, Title 49, *Transportation*, Part 172, “Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.”

49 CFR Part 173. Code of Federal Regulations, Title 49, *Transportation,* Part 173, “Shippers - General Requirements for Shipments and Packagings.”

49 CFR Part 178. Code of Federal Regulations, Title 49, *Transportation,* Part 178, “Specifications for Packagings.”

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Appendix I

Plant Parameter Envelope Values

Appendix I

Plant Parameter Envelope Values

This appendix contains the System Energy Resources, Inc. plant parameter envelope for the proposed Grand Gulf early site permit site as submitted in System Energy Resources, Inc. environmental report (SERI 2005) as Tables 3.0-1 to 3.0-9 and reproduced here as Table I-1.

Table I-1. PPE for the Grand Gulf Early Site Permit Facility

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TABLE 3.0-1

PLANT PARAMETERS ENVELOPE (PPE)

PPE Section / Parameter[6]		Composite Value[1]	Comments	Value[2]
1.	Structures			
1.1	Building Characteristics			
1.1.2	Foundation Embedment	140 ft.		US
2.	Normal Plant Heat Sink			
2.3	Condenser			
2.3.2	Condenser / Heat Exchanger Duty	10.7 E9 Btu/hr		US
2.4	NHS Cooling Towers - Mechanical Draft (or Natural Draft) (See Note 3)			
2.4.3 (2.5.3)	Blowdown Constituents and Concentrations	See TABLE 3.0-2		US
2.4.4 (2.5.4)	Blowdown Flow Rate	12,800 gpm expected (39,000 gpm max)		TP
2.4.5 (2.5.5)	Blowdown Temperature	100°F		US
2.4.6 (2.5.6)	Cycles of Concentration	4		US
2.4.7 (2.5.7)	Evaporation Rate	35,100 gpm expected (39,000 gpm max)		TP
2.4.8 (2.5.8)	Height	60 ft (475 ft / 550 ft)	See Note 5	US
2.4.9 (2.5.9)	Makeup Flow Rate	47,900 gpm expected (78,000 gpm max)		TP
2.4.10 (2.5.10)	Noise	55 dba @ 1000 ft		US
2.4.12 (2.5.12)	Cooling Water Flow Rate	865,000 gpm		US
3.	Ultimate Heat Sink			
3.3	Mech Draft Cooling Towers			
3.3.4	Blowdown Flow Rate	288 gpm expected (1700 gpm max)		TP
3.3.5	Blowdown Temperature	95°F		US
3.3.7	Evaporation Rate	822 gpm expected (1700 gpm max)		TP
3.3.9	Makeup Flow Rate	1110 gpm expected (3,400 gpm max)		TP

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TABLE 3.0-1 (Continued)

PPE Section / Parameter [6]		Composite Value [1]	Comments	Value [2]
3.3.12	Cooling Water Flow Rate	26,125 gpm (normal) 52,250 gpm (shutdown / accident)		US
5.	Potable Water/Sanitary Waste System			
5.1	Discharge to Site Water Bodies			
5.1.1	Flow Rate	120 gpm expected (210 gpm max)		TP
5.2	Raw Water Requirements			
5.2.1	Maximum Use	240 gpm		TP
5.2.2	Monthly Average Use	180 gpm		TP
6.	Demineralized Water System			
6.1	Discharge to Site Water Bodies			
6.1.1	Flow Rate	220 gpm expected (290 gpm max)		TP
6.2	Raw Water Requirements			
6.2.1	Maximum Use	1440 gpm		TP
6.2.2	Monthly Average Use	1100 gpm		TP
7.	Fire Protection System			
7.1	Raw Water Requirements			
7.1.1	Maximum Use	1890 gpm		TP
7.1.2	Monthly Average Use	(30 gpm)		TP
8.	Miscellaneous Drain			
8.1	Discharge to Site Water Bodies			
8.1.1	Flow Rate	200 gpm expected (300 gpm max)		TP
9.	Unit Vent/Airborne Effluent Release Point			
9.4	Release Point			
9.4.2	Elevation (Normal)	Ground level		US
9.4.3	Elevation (Post Accident)	Ground level		US
9.4.4	Minimum Distance to Site Boundary	0.52 mi (841 m) exclusion area		US
9.5	Source Term			
9.5.1	Airborne Effluents (Normal)	32,699 Ci/yr	See TABLE 3.0-7	US

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TABLE 3.0-1 (Continued)

PPE Section / Parameter [6]		Composite Value [1]	Comments	Value [2]
9.5.2	Airborne Effluents (Post-Accident)	Based on limiting DBAs.	See Note 4	US
9.5.3	Tritium Airborne Effluent Normal)	7060 Ci/yr		TP
10.	Liquid Radwaste System			
10.2	Release Point			
10.2.1	Flow Rate	35 gpm		US
10.3	Source Term			
10.3.1	Liquid	0.694 Ci/yr	See TABLE 3.0-8	US
10.3.2	Tritium	6,200 Ci/yr	See TABLE 3.0-8	US
11.	Solid Radwaste System			
11.2.1	Activity	5400 Ci/yr		TP
11.2.2	Principal Radionuclides	See TABLE 3.0-3		US
11.2.3	Volume	18,646 ft^3/yr		TP
13.	Auxiliary Boiler System			
13.2	Flue Gas Effluents	See TABLE 3.0-4		US
16.	Standby Power System			
16.1	Diesels			
16.1.3	Diesel Flue Gas Effluents	See TABLE 3.0-5		US
16.2	Gas Turbines			
16.2.3	Gas-Turbine Flue Gas Effluents	See TABLE 3.0-6		US
17.	Plant Characteristics			
17.3	Megawatts Thermal	4300 MWt	Includes allowance for ~10% uprate from design core power of 3,926 MWt.	US
17.4	Plant Design Life	60 years		US
17.5	Plant Population			
17.5.1	Operation	1160		TP
18.	Construction			
18.3.1	Noise	76-101 db @ 50 ft		US
18.4	Plant Population			
18.4.1	Construction	3150 people max		US

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TABLE 3.0-1 (Continued)

NOTES:

1. The "Composite Value" provides an envelope (bounding values) for design parameters for the various plant designs considered for the site. See Site Safety Analysis Report Section 1.3 for a discussion of the basis for parameter values.
2. "Value" pertains to the "Composite Value" for each parameter listed. In this table, a value designated "US" represents a "unit specific" value, meaning that it is applied per unit, or group of units or modules. A designation of "TP" is given to a value that represents total facility requirements. See Site Safety Analysis Report Section 1.3 for a discussion of the basis for parameter values.
3. Several main condenser cooling system alternatives were considered (i.e., mechanical and natural draft cooling towers, cooling ponds, and once-through cooling). The most restrictive value for each cooling system PPE section has been used in this table (e.g., 550 ft cooling tower height selected since both mechanical and natural draft towers were considered).
   - The once through cooling option was eliminated due to significant environmental impact.
   - The cooling pond option was eliminated due to insufficient GGNS site acreage to accommodate pond.
4. In general, source terms for any given accident are those used by the Vendors in their safety analyses. The methodologies used by the Vendors for establishing source terms include those established in TID-14844 and Regulatory Guide 1.183. See SSAR Sections 3.3.2 and 3.3.3 for additional detail on accident selection and source term methods.
5. For the purposes of environmental (aesthetic) impact, a natural draft cooling tower with a height of 550 ft is considered. The cooling tower plume model discussed in Section 5.3.3.1 of the ER was done assuming a natural draft cooling tower height of 475 ft., and a mechanical draft cooling tower height of 60 ft.
6. A definition for each parameter is provided in Table 3.0-9.

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TABLE 3.0-2

BLOWDOWN CONSTITUENTS AND CONCENTRATIONS[1]

	Concentration (ppm)[2, 3]		
Constituent	River Source	Well / Treated Water	Envelope
Chlorine demand	10.1	--	10.1
Free available chlorine	0.5	--	0.5
Chromium	--	--	--
Copper	--	6	6
Iron	0.9	3.5	3.5
Zinc	--	0.6	0.6
Phosphate	--	7.2	7.2
Sulfate	600	3,500	3,500
Oil and grease	--	--	--
Total dissolved solids	--	17,000	17,000
Total suspended solids	50	150	150
BOD, 5-day	--	--	--

NOTES:

1. See PPE Table 3.0-1 Sections 2.4.3 and 2.5.3.
2. Assumed cycles of concentration equals 4.
3. Concentrations are per unit/group of units, as applicable.

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TABLE 3.0-3

PRINCIPAL RADIONUCLIDES IN SOLID RADWASTE [1]

Radionuclide [3]	Quantity (Ci/yr)
Fe-55	1761.37
Fe-59	1.35
Co-60	395.92
Mn-54	347.22
Cr-51	97.138
C0-58	93.6
NI-63	279
H-3	1.5
C-14	0.3
Nb-95	162
Ag-110m	9
Zr-95	76.45
Ba-140	0.528
Pu-241	0.09
La-140	0.607
Other	72.858
Cs-134	605
Cs-137	507
Sr-90	1.24
I-131	81.91
Ba-137m	507
Na-24	0.44
Ru-103	2.18
Ru-106	1.37
Sb-124	11.29
I-133	4.55
Ce-141	0.14
Ce-144	0.11
Gd-153	3.09
CS-136	0.0287
Zn-65	25.7
Sr-89	0.886
Y-90	1.24
Y-91	4.43 E-4
Rh-103m	1.22 E-3
Rh-106	0.0592
Te-129m	2.31 E-5
Te-129	1.51 E-5
Total (rounded to nearest hundred) [2]	5400

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TABLE 3.0-3 (Continued)

NOTES:

1. See PPE Table 3.0-1 Section 11.2.2.
2. This is the bounding total for twice the single unit or group of units, not the total of the bounding quantities above.
3. Individual Radionuclide quantities must be doubled since they represent data for a single unit or group of units.

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TABLE 3.0-4

YEARLY EMISSIONS AUXILIARY BOILERS[1]

Pollutant Discharged[2, 3]	Quantity (lbs)
Particulates	17,250
Sulfur oxides	51,750
Carbon monoxide	1749
Hydrocarbons	50,100
Nitrogen oxides	19,022

NOTES:

1. See PPE Table 3.0-1 Section 13.2.
2. Emissions are based on 30 days/yr operation.
3. Individual quantities must be doubled since they represent data for a single unit or group of units.

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TABLE 3.0-5

YEARLY EMISSIONS FROM STANDBY DIESEL GENERATORS [1]

Pollutant Discharged [2]	Quantity (lbs)
	Total All DGs [3]
Particulates	1230
Sulfur oxides	4,608
Carbon monoxide	4,600
Hydro-carbons	3,070
Nitrogen oxides	28,968

NOTES:
1. See PPE Table 3.0-1 Section 16.1.3.
2. Emissions are based on 4 hrs/month operation for each of the diesel generators.
3. Individual quantities must be doubled since they represent data for a single unit or group of units.

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TABLE 3.0-6

YEARLY STANDBY POWER SYSTEM GAS TURBINE FLUE GAS EFFLUENTS[1]

Gas Turbine Capacity (MWe)	20 MWe
Distillate 20°F Ambient BTU/KWH (LHV) [3]	9,890
BTU/KWH (HHV)	10,480
Fuel Consumption Rate (lbs/hr) [3]	121,200
Effluent	**Quantity [2, 3] (lbs or PPMVD)**
NOX (PPMVD @ 15% O2	42
NOX as NO2 (lbs)	2016
CO (PPMVD)	31
CO (lbs)	912
UHC (PPMVD)	3
UHC (lbs)	48
VOC (PPMVD)	N/A
VOC (lbs)	10
SO2 (PPMVD)	N/A
SO2 (lbs)	1882
SO3 (PPMVD)	N/A
SO3 (lbs)	30
SULFUR MIST (lbs)	50
PARTICULATES (lbs)	22
Exhaust Analysis (% Vol)	(% Vol)
ARGON	0.87
NITROGEN	72.56
OXYGEN	12.52
CARBON DIOXIDE	5.19
WATER	9.87

NOTES:

1. See PPE Table 3.0-1 Section 16.2.3.
2. Emissions are based on 4 hrs/month operation for each of the gas turbines.
3. Individual quantities must be doubled since they represent data for a single unit or group of units.

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TABLE 3.0-7

NORMAL OPERATIONS GASEOUS RELEASE SOURCE TERM[1]

Radionuclide	Composite Normal Release[2] (Ci/yr)	Radionuclide	Composite Normal Release[2] (Ci/yr)
Kr-83m	1.68E-03	Rb-89	8.65E-05
Kr-85m	7.20E+01	Sr-89	1.14E-02
Kr-85	8.20E+03	Sr-90	3.60E-03
Kr-87	5.03E+01	Y-90	9.19E-05
Kr-88	9.20E+01	Sr-91	2.00E-03
Kr-89	4.81E+02	Sr-92	1.57E-03
Kr-90	6.49E-04	Y-91	4.81E-04
Xe-131m	3.60E+03	Y-92	1.24E-03
Xe-133m	1.74E+02	Y-93	2.22E-03
Xe-133	9.20E+03	Zr-95	3.19E-03
Xe-135m	8.11E+02	Nb-95	1.68E-02
Xe-135	9.19E+02	Mo-99	1.19E-01
Xe-137	1.03E+03	Tc-99m	5.95E-04
Xe-138	8.65E+02	Ru-103	7.03E-03
Xe-139	8.11E-04	Rh-103m	2.22E-04
I-131	5.19E-01	Ru-106	2.34E-04
I-132	4.38E+00	Rh-106	3.78E-05
I-133	3.41E+00	Ag-110m	4.00E-06
I-134	7.57E+00	Sb-124	3.62E-04
I-135	4.81E+00	Sb-125	1.83E-04
C-14	2.19E+01	Te-129m	4.38E-04
Na-24	8.11E-03	Te-131m	1.51E-04
P-32	1.84E-03	Te-132	3.78E-05
Ar-41	1.02E+02	Cs-134	1.24E-02
Cr-51	7.03E-02	Cs-136	1.19E-03
Mn-54	1.08E-02	Cs-137	1.89E-02
Mn-56	7.03E-03	Cs-138	3.41E-04
Fe-55	1.30E-02	Ba-140	5.41E-02
Co-57	2.46E-05	La-140	3.62E-03
Co-58	6.90E-02	Ce-141	1.84E-02
Fe-59	1.62E-03	Ce-144	3.78E-05
Co-60	2.61E-02	Pr-144	3.78E-05
Ni-63	1.30E-05	W-187	3.78E-04
Cu-64	2.00E-02	Np-239	2.38E-02
Zn-65	2.22E-02		
		Total without Tritium	25,639
		Tritium (H-3)	7.06E+03
		Total with Tritium	32,699

NOTES:

1. See PPE Table 3.0-1, Section 9.5.1 and 9.5.3.
2. Composite source term based on highest Radionuclide release for all plant types considered.

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TABLE 3.0-8

NORMAL OPERATIONS LIQUID RELEASE SOURCE TERM [1]

Radionuclide	Composite Normal Release [2] (Ci/yr)	Radionuclide	Composite Normal Release [2] (Ci/yr)
I-131	2.826E-02	Zr-95	2.080E-03
I-132	5.200E-03	Nb-95	3.820E-03
I-133	2.000E-02	Mo-99	1.659E-03
I-134	3.400E-03	Tc-99m	1.600E-03
I-135	1.503E-02	Ru-103	9.860E-03
H-3	6.200E+03	Rh-103m	9.860E-03
C-14	8.800E-04	Ru-106	1.470E-01
Na-24	5.622E-03	Rh-106	1.470E-01
P-32	3.600E-04	Ag-110	2.800E-04
Cr-51	1.541E-02	Ag-110m	2.100E-03
Mn-54	5.200E-03		
Mn-56	7.622E-03	Sb-124	1.358E-03
Co-57	1.438E-04	Te-129	3.000E-04
Co-58	6.720E-03	Te-129m	2.400E-04
Co-60	1.822E-02	Te-131	6.000E-05
Fe-55	1.162E-02	Te-131m	1.800E-04
Fe-59	4.000E-04	Te-132	4.800E-04
Ni-63	2.800E-04	Cs-134	1.986E-02
Cu-64	1.503E-02	Cs-136	1.260E-03
Zn-65	8.200E-04	Cs-137	2.664E-02
Br-84	4.000E-05	Ba-137m	2.490E-02
Rb-88	5.400E-04	Cs-138	3.800E-04
Rb-89	8.811E-05	Ba-140	1.104E-02
Sr-89	2.200E-04	La-140	1.486E-02
Sr-90	7.027E-05	Ce-141	2.400E-04
Y-90	6.216E-06	Ce-143	3.800E-04
Sr-91	1.800E-03	Ce-144	6.320E-03
Y-91	2.200E-04	Pr-143	2.600E-04
Y-91m	2.000E-05	Pr-144	6.320E-03
Sr-92	1.600E-03	W-187	2.600E-04
Y-92	1.200E-03	Np-239	6.216E-03
Y-93	1.800E-03	All Others	4.000E-05
		Total All w/o Tritium	6.941E-01
		Total Tritium	6.200E+03

NOTES:

1. See PPE Table 3.0-1, Section 10.3.
2. Composite source term based on highest Radionuclide release for all plant types considered.

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TABLE 3.0-9

PLANT PARAMETERS DEFINITIONS

Parameter	Units	Definition	Bounding Value (Footnotes)
1.1 Building Characteristics			
1.1.2 Foundation Embedment	Feet	The depth from finished grade to the bottom of the basemat for the most deeply embedded power block structure.	1
2. Normal Plant Heat Sink			
2.3 Condenser			
2.3.2 Condenser / Heat Exchanger Duty	BTU per hour	Design value for the waste heat rejected to the circulating water system across the normal heat sink condensers.	2
2.4 (2.5) NHS Cooling Towers (Mechanical Draft or Natural Draft)			
2.4.3 (2.5.3) Blowdown Constituents and Concentrations	Ppm	The maximum expected concentrations for anticipated constituents in the cooling water systems blowdown to the receiving water body.	2
2.4.4 (2.5.4) Blowdown Flow Rate	Gallons per minute	The normal (and maximum) flow rate of the blowdown stream from the cooling water systems to the receiving water body for closed system designs.	2
2.4.5 (2.5.5) Blowdown Temperature	°F	The maximum expected blowdown temperature at the point of discharge to the receiving water body.	1
2.4.6 (2.5.6) Cycles of Concentration	Number of cycles	The ratio of total dissolved solids in the cooling water blowdown streams to the total dissolved solids in the makeup water streams.	1
2.4.7 (2.5.7) Evaporation Rate	Gallons per minute	The expected (and maximum) rate at which water is lost by evaporation from the cooling water systems.	2
2.4.8 (2.5.8) Height	Feet	The vertical height above finished grade of either natural draft or mechanical draft cooling towers associated with the cooling water systems.	1
2.4.9 (2.5.9) Makeup Flow Rate	Gallons per minute	The expected (and maximum) rate of removal of water from a natural source to replace water losses from closed cooling water systems.	2
2.4.10 (2.5.10) Noise	Decibels	The maximum expected sound level produced by operation of a cooling tower, measured at 1000 feet from the noise source.	1
2.4.12 (2.5.12) Cooling Water Flow Rate	Gallons per minute	The total cooling water flow rate through the normal heat sink condensers/heat exchangers.	1
3. Ultimate Heat Sink			
3.3 Mechanical Draft Cooling Towers			
3.3.4 Blowdown Flow Rate	Gallons per minute	The normal (and maximum) flow rate of the blowdown stream from the UHS system to receiving water body for closed system designs.	2
3.3.5 Blowdown Temperature	°F	The maximum expected UHS blowdown temperature at the point of discharge to the receiving water body.	1

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TABLE 3.0-9 (Continued)

Parameter	Units	Definition	Bounding Value (Footnotes)
3.3.7 Evaporation Rate	Gallons per minute	The expected (and maximum) rate at which water is lost by evaporation from the UHS system.	2
3.3.9 Makeup Flow Rate	Gallons per minute	The expected (and maximum) rate of removal of water from a natural source to replace water losses from the UHS system.	2
3.3.12 Cooling Water Flow Rate	Gallons per minute	The total cooling water flow rate through the UHS system.	1
5. Potable Water/Sanitary Waste System			
5.1 Discharge to Site Water Bodies			
5.1.1 Flow Rate	Gallons per minute	The expected (and maximum) effluent flow rate from the potable and sanitary waste water systems to the receiving water body.	3
5.2 Raw Water Requirements			
5.2.1 Maximum Use	Gallons per minute	The maximum short-term rate of withdrawal from the water source for the potable and sanitary waste water systems.	2
5.2.2 Monthly Average Use	Gallons per minute	The average rate of withdrawal from the water source for the potable and sanitary waste water systems.	2
6. Demineralized Water System			
6.1 Discharge to Site Water Bodies			
6.1.1 Flow Rate	Gallons per minute	The expected (and maximum) effluent flow rate from the demineralized water processing system to the receiving water body.	3
6.2 Raw Water Requirements			
6.2.1 Maximum Use	Gallons per minute	The maximum short-term rate of withdrawal from the water source for the demineralized water system.	2
6.2.2 Monthly Average Use	Gallons per minute	The average rate of withdrawal from the water source for the demineralized water system.	2
7. Fire Protection System			
7.1 Raw Water Requirements			
7.1.1 Maximum Use	Gallons per minute	The maximum short-term rate of withdrawal from the water source for the fire protection water system.	2
7.1.2 Monthly Average Use	Gallons per minute	The average rate of withdrawal from the water source for the fire protection water system.	2
8. Miscellaneous Drain			
8.1 Discharge to Site Water Bodies			
8.1.1 Flow Rate	Gallons per minute	The expected (and maximum) effluent flow rate from miscellaneous drains to the receiving water body.	2

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TABLE 3.0-9 (Continued)

Parameter	Units	Definition	Bounding Value (Footnotes)
9. Unit Vent/Airborne Effluent Release Point			
9.4 Release Point			
9.4.2 Elevation (Normal Operation)	Feet	The elevation above finished grade of the release point for routine operational releases.	3
9.4.3 Elevation (Post Accident)	Feet	The elevation above finished grade of the release point for accident sequence releases.	3
9.4.4 Minimum Distance to Site Boundary	Feet	The minimum lateral distance from the release point to the site boundary.	3
9.5 Source Term			
9.5.1 Airborne Effluents (Normal)	Curies per year	The annual activity, by isotope, contained in routine (normal) plant airborne effluent streams.	2
9.5.2 Airborne Effluents (Post-Accident)	Curies	The activity, by isotope, activity contained in post-accident airborne effluents.	1
9.5.3 Tritium Airborne Effluents (Normal)	Curies per year	The annual activity of tritium contained in routine (normal) plant airborne effluent streams.	2
10. Liquid Radwaste System			
10.2 Release Point			
10.2.1 Flow Rate	Gallons per minute	The flow rate of liquid potentially radioactive effluent streams from plant systems to the receiving water body.	2
10.3 Source Term			
10.3.1 Liquid	Curies per year	The annual activity, by isotope, contained in routine plant liquid effluent streams.	2
10.3.2 Tritium	Curies per year	The annual activity of tritium contained in routine plant airborne effluent streams.	2
11. Solid Radwaste System			
11.2.1 Activity	Curies per year	The annual activity, by isotope, contained in solid radioactive wastes generated during routine plant operations.	2
11.2.2 Principal Radionuclides	Curies per year	The principal radionuclides contained in solid radioactive wastes generated during routine plant operations.	2
11.2.3 Volume	Cubic feet per year	The expected volume of solid radioactive wastes generated during routine plant operations.	2
13. Auxiliary Boiler System			
13.2 Flue Gas Effluents	Pounds per year	The expected combustion products and anticipated quantities released to the environment due to operation of auxiliary boilers.	2
16. Standby Power System			
16.1 Diesel			
16.1.3 Diesel Flue Gas Effluents	Pounds per year	The expected combustion products and anticipated quantities released to the environment due to operation of the emergency standby diesel generators.	1

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TABLE 3.0-9 (Continued)

Parameter	Units	Definition	Bounding Value (Footnotes)
16.2 Gas-Turbine			
16.2.3 Gas-Turbine Flue Gas Effluents	Pounds per year	The expected combustion products and anticipated quantities released to the environment due to operation of the emergency standby gas-turbine generators.	1
17. Plant Characteristics			
17.3 Megawatts Thermal	Mega-watts	The maximum thermal power generated by a single unit or group of units/modules of a specific reactor plant type.	2
17.4 Plant Design Life	Years	The life for which the plant is designed to operate.	1
17.5 Plant Population			
17.5.1 Operation	Persons	The number of people required to operate and maintain the plant.	2
17.6 Station Capacity Factor	Percent	The percentage of time that a plant is capable of providing power to the grid.	1
18. Construction			
18.4 Plant Population			
18.4.1 Construction	Persons	The number of people required to construct the plant.	2

NOTES:

1. The Bounding Value is the maximum value for any of the plant designs being considered for the site.
2. The Bounding Value is the maximum value for any of the plant design/number of unit combinations being considered for the site.
3. The Bounding Value is the minimum value for any of the plant designs being considered for the site.

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Appendix J

System Energy Resources, Inc. Commitments and NRC Staff Assumptions Relevant to the Analysis of Impact

Appendix J

System Energy Resources, Inc. Commitments and NRC Staff Assumptions Relevant to the Analysis of Impact

Throughout the environmental report supporting the Grand Gulf Early Site Permit (ESP) application (SERI 2005), System Energy Resources, Inc. (SERI) provides:

(1) Commitments to address certain issues in the design, construction, and operation of the facility

(2) Statements of planned compliance with current laws, regulations, and requirements

(3) Commitments to future activities and actions that it will take should it be granted an ESP and decide to apply for a construction permit (CP) or combined license (COL)

(4) Descriptions of SERI's estimate of the environmental impacts resulting from the construction and operation of a new nuclear unit or units on the Grand Gulf ESP site

(5) Descriptions of SERI's estimates of future activities and actions of others and the likely environmental impacts of those activities and actions that would be expected should it be granted an ESP and decide to apply for a CP or COL.

Those statements are discussed throughout this environmental impact statement (EIS) and are listed in this Appendix.[(a)] Some of those statements considered by the staff in determining the level of impacts to a resource are related to matters that are within SERI's control. Table J-1 lists those matters that were considered in the staff's evaluation of the environmental impacts related to the construction and operation of a new nuclear unit or units at the Grand Gulf ESP site. The table shows the technical area where the matter is addressed in the EIS, and SERI's statement that addresses the matter. Table J-2 lists assumptions related to likely activities and actions of others that were considered by the staff.

In some cases, the same statement or similar statements are made in more than one place in the environmental report. Where statements contain essentially the same information, the location of the more comprehensive statements are listed first in the table, and the text provided is the text from that location.

(a) The listings are not intended to be a complete list of the commitments described in the SERI environmental report.

Table J-1. Statements Made in the SERI Environmental Report and in Response to NRC Staff Requests for Additional Information Related to Future Actions and Activities by SERI and the Impacts of Those Activities Considered in the Staff's Analysis

Technical Area	Environmental Report or RAI Statement
Land Use	The Universal Transverse Mercator Grid Coordinates for the location of the new reactor(s) on the site are approximately N3,543,261 meters and E684,018 meters.
Land Use	There is no rail service in the vicinity of the Grand Gulf Nuclear Station (GGNS) site and there are no active railroad tracks that traverse the GGNS site or the vicinity surrounding the site.
Land Use	Entergy Operations allows access to parts of the plant site property for recreational purposes. The site is posted to ensure awareness of access restrictions by individuals.
Land Use	There is no activity at the GGNS plant site to explore for, drill for, or otherwise extract minerals. Past unsuccessful exploratory activities on or near the GGNS plant site and the geological character of the subsurface structure in the vicinity of the GGNS plant site indicate that commercial mineral production appears unlikely in the foreseeable future.
Land Use	Information from the Claiborne County Extension office at the present time indicated that there are approximately 300 to 400 head of cattle within a 6 mile radius of the site, and most of the cattle are located southwest of the plant. There are no milk cows or swine within Claiborne County.
Land Use	Dredging would be required to form the embayment. The embayment bottom would be at approximately elevation 15 ft msl.
Land Use	There are three transmission lines associated with GGNS: (1) the Baxter-Wilson line, a 22-mile single-circuit 500 kV transmission line connecting GGNS to the Baxter-Wilson EHV Substation near Vicksburg, Mississippi; (2) the Franklin line, a 43.6-mile single-circuit 500 kV transmission line connecting the GGNS switchyard to the Franklin EHV Substation; and, (3) the Port Gibson line, a 5.5-mile single-circuit 115 kV transmission line connecting the GGNS switchyard to the Port Gibson Substation. The electrical power generated by GGNS Unit 1 is transmitted by interconnection with 500 kV transmission facilities that were in existence when Unit 1 was constructed.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Land Use	The power transmission and distribution (T&D) system existing at the time of the new facility startup and operation will be relied upon to distribute the electricity generated by a new facility at Grand Gulf. In support of site selection evaluation work (environmental report, Section 9.3), a sensitivity analysis of the T&D system was performed to assess transmission injection capability for the new potential electrical power generation at GGNS. This study concluded that the existing T&D system is adequate for at least an additional 1311 MW(e) of generating capacity, provided that certain modifications were accomplished.
Land Use	When the specific facility design, the expected electrical output, the need for power, and primary market location(s) are established, the adequacy of the existing (at that time) T&D system to support the new facility will be determined. If, at that time, additional changes to the T&D system were warranted, the associated environmental impacts would be evaluated.
Land Use	An estimated 400 acres of the 2100-acre GGNS site would be affected by construction of a new facility.
Land Use	Of the approximately 400 acres estimated for the construction of a new facility, approximately 120 acres overlap currently developed or previously altered areas. It is estimated that approximately 125 acres would contain permanent structures (primarily a power block area, cooling tower area, and bottom land pipeline and intake areas.
Land Use	The barge slip constructed for GGNS Unit 1 would be used to offload large equipment and materials for the construction of a new facility transported by river.
Land Use	There would be some impact from excavation and construction of the intake structure along the river bank in the flood plain areas, but the impact is expected to be small and temporary. Additionally, trenching from the intake to the proposed power block location on the bluffs east of the river would be required to lay supply and discharge piping from the new facility. Most of the floodplain areas are also classified as wetlands.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Land Use	Makeup water (cooling tower makeup and other raw water needs) for a new facility would be supplied primarily from the Mississippi River via an embayment, and associated intake structure, located on the east bank of the river and on the north side of the existing barge slip. Dredging would be required to form the embayment on the Mississippi River... Riprap, or other appropriate means, would be used to stabilize the banks of the embayment and the river shoreline around the embayment during and following construction. These construction activities would be done in compliance with Corps of Engineer requirements...
Land Use	The proposed outfall, located above normal river water level, would include a concrete drainage course to the river similar to that for the GGNS Unit 1 discharge structure.
Land Use	It is anticipated that the existing road system would be adequate for construction of a new facility, and new road construction would not be necessary.
Land Use	Use of Hamilton and Gin Lakes for recreational fishing may be temporarily restricted during construction as a safety measure to protect members of the public from hazards related to the use of heavy construction equipment. Therefore, the impact to recreational users of these lakes would be minimal.
Land Use	Approximately 145 acres of upland forest and approximately 105 acres of upland fields would be affected by the construction of a new facility (Figure 2.4-3). This represents approximately 35% and 66% of these habitat types within the GGNS site, respectively... Approximately 100 acres of the upland area of the GGNS site would be permanently altered (i.e., for structures, parking lots, etc.) for a new facility. The remaining acreage disturbed by construction would be revegetated or reseeded and allowed to develop back into a stable ecological community.
Land Use	Approximately 30 acres of bottomland palustrine, forested, seasonally flooded wetland would be disturbed during the construction of a new facility (Figure 2.4-3). This is approximately 3% of this habitat type within the GGNS site property. The remainder of the area required for construction would be in areas previously disturbed for the construction of GGNS Unit 1 (e.g., heavy haul road, barge slip area).
Land Use	Additional re-routing of onsite drainages and construction of additional sediment retention basins would likely be required to support construction of a new facility. A buffer zone of native vegetation could be maintained between the construction areas and the lakes.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Land Use	Operation of a new facility is not expected to produce any additional significant impacts to land use on the site nor in the vicinity of the GGNS site... These recreational areas may experience increased visitation due to the operational work force at a new facility. No other impacts to these recreational facilities would be expected.
Land Use	The bounding estimate of salt deposition from the operation of cooling towers would be approximately 8 lbm/100-acre-month ... This amount of deposition would not be expected to cause damage to vegetation in the vicinity of the GGNS site. Therefore, no significant impact to land use from cooling tower drift is expected on the site. And, based on proposed cooling tower(s) distance from the site boundary, and the prevailing wind direction, none is expected beyond the site boundaries.
Land Use	The rail line, which extended from Vicksburg to the site and beyond, and the spur constructed to the site to support GGNS Unit 1 construction, have since been abandoned. To support transport of heavy materials and equipment to the site, new rail service will likely be required. This may involve reconstruction of rail tracks along the former rights of way, or construction of new rail lines.
Land Use (response to RAI 4.1-1)	The statement quoted from the Environmental Report is intended to identify that the precise methods of construction material transportation to the site have not been determined or projected and that rail service is not immediately available at the site. The Environmental Report does not propose, project or evaluate possible changes to rail service. Many variables could affect potential future construction material transportation modes, including the degree to which modular construction methods are to be used. Although not evaluated for the ESP, the Environmental Report does not preclude future consideration and evaluation of rail service.
Land Use (response to RAI 2.5.3-1)	NRC staff considered the aerial photos of the GGNS construction in the evaluation of ESP facility construction impacts.
Land Use	Additional analysis would be necessary to confirm whether, beyond the addition of 1311 MW(e), any supporting T&D system upgrades or changes would be required, and what the associated operational environmental impacts would be. This additional analysis was not pursued at ESP.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Land Use	The occurrence of icing conditions even in the vicinity of the linear mechanical draft cooling towers (LMDCTs) is expected to be rare since the water deposition rate is small and prolonged periods with below freezing temperatures are infrequent. Because any icing would be confined within the site property boundary, no adverse impact on surrounding public lands or roadways would occur.
Land Use	Based on the results of the evaluation performed for this application, the guidance provided in NUREG-1555, and the results of the Cooling Tower Drift Program performed for the existing GGNS facility, no adverse impact on the surrounding vegetation from salt deposition due to the operation of the NHS cooling towers for the new facility is anticipated.
Land Use	The majority of in-migrants and their families would be expected to settle in developed, more populous areas, or their suburbs, such as Vicksburg (Warren County), Natchez (Adams County), and Clinton/Jackson (Hinds County), which have a combined year 2000 population of over 300,000 people.
Land Use	The temporary outage staff typically stays in area hotels or recreational vehicle courts dispersed throughout the region; therefore, no single community would be overburdened by the influx of temporary workers. It is expected that the increased frequency of the temporary outage staff would not significantly impact the region.
Land Use	Empirical case studies of seven operating nuclear power plants indicated in all instances that the in-migration of plant personnel had small impacts on housing. In addition, the workers would not move exclusively to one community but rather would be expected to make residences in the relatively large area formed by surrounding communities.
Land Use	It is possible that the influx of site workers would increase demand for and stimulate the development of some commercial businesses (e.g., gasoline and automotive service stations, restaurants, etc). However, these services would likely be confined to existing commuter routes, and would not represent a major land use change for the region.
Meteorology and Air Quality	The normal plant heat sink (NHS) that will be used to dissipate heat from the turbine cycle for the new facility will utilize cooling towers to dissipate the heat directly to the atmosphere.
Meteorology and Air Quality	The cycles of concentration for the NHS circulating water is expected to be a maximum of 4, which will result in the concentrations in the circulating water being 4 times that of river water.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Meteorology and Air Quality	Seasonal and Annual Cooling Tower Impact (SACTI) model predicts that the majority of the fogging due to the operation of the LMDCTs will be confined to within about ½ mile (800 m) to the south to southeast of the towers with occasional fogging (approximately 2 hrs/yr) up to about ¾ mile (1200 m) to the south to southeast of the towers (this area is entirely within the property boundary of the site). Therefore, it is predicted that the operation of the LMDCTs will result in limited increased fogging at the site.
Meteorology and Air Quality	The towers will use drift eliminators to minimize the amount of water lost from the towers via drift.
Meteorology and Air Quality	Gaseous emissions will be within regulatory guidelines set by Federal and State agencies.
Meteorology and Air Quality	The meteorological monitoring program will be the same throughout the pre-construction and operational phases of the project. The monitoring program will simply be a continuation of the ongoing meteorological monitoring program for the GGNS Unit 1 facility.
Ecology	It will be required to coordinate with the Corps of Engineers and/or other appropriate regulatory agencies and obtain permits for construction of the embayment and intake structure when the final design of the intake structure and its exact location are defined. The design and placement of the embayment and intake structure will be in accordance with the Corps guidance, MDEQ and EPA requirements, and good engineering practice.
Ecology	The normal heat sink circulating water system for the new facility will be a closed-cycle type system using either hyperbolic natural draft cooling towers or mechanical draft cooling towers.
Ecology	The design and placement of the embayment and intake structure will be in accordance with the Corps of Engineers guidance, MDEQ and EPA requirements, and good engineering practice.
Ecology	The Corps of Engineers has completed revetments along the east and west river banks... It is expected that these measures will stabilize the Mississippi River shoreline near the site.
Ecology	This portion of the switchyard would be used, with modifications.
Ecology	Plant makeup (cooling tower makeup and other raw water needs) for a new facility would be supplied from the Mississippi River via an intake structure located on the east bank of the river.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Ecology	The Corps of Engineers continues to evaluate the need for additional shoreline work, and would be expected to make improvements as considered appropriate. However, those actions would not be expected to impact site suitability.
Ecology	Makeup to the normal heat sink cooling towers, balance of plant cooling systems (e.g., plant service water), and other raw water makeup needs for a new facility would be supplied by an intake structure located on the east bank of the Mississippi River.
Ecology	The new facility owner would be required to coordinate with the Corps of Engineers and obtain permits from appropriate regulatory agencies for construction of the embayment and intake structure when the final design of the embayment and intake structure and its exact location are defined.
Ecology	Eagles nesting on site would be largely protected from shooting, development and habitat alteration, and other human disturbance that usually accounts for mortality and reduced breeding success elsewhere.
Ecology	Other than the installation of additional revetments along the east bank, no significant changes to the river channel or banks which would be expected to alter the ecological characteristics of this riparian habitat have occurred.
Ecology	Makeup water to the cooling tower(s) and supply or makeup water for the SWS will be withdrawn directly from the Mississippi River through an intake structure on the river shore.
Ecology	The power transmission and distribution (T&D) system existing at the time of the new facility startup and operation will be relied upon to distribute the electricity generated by a new facility at Grand Gulf.
Ecology	When the specific facility design, the expected electrical output, the need for power, and primary market location(s) are established, the adequacy of the existing (at that time) T&D system to support the new facility will be determined.
Ecology	Construction activities to be conducted within a floodplain on the site would be the water intake structure and embayment along with other items that are a part of that water intake facility. This water intake will be located at or near the existing barge slip area.
Ecology	Once the facility design is finalized, appropriate analyses of transmission and distribution system adequacy will be made.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Ecology	Traffic on Grand Gulf Road will increase substantially during the peak construction period, and will be at its peak during the morning and evening shift changes. Noise in the general area will increase from this increased traffic but the increases will be temporary, and will only occur as indicated twice per day, during the week.
Ecology	The new facility will require a small amount of water withdrawal relative to normal river flow; makeup flow requirements are estimated at approximately 85,000 gpm.
Ecology	There is little potential that operation of the cooling system intake for a new facility at the Grand Gulf ESP site will impact any such areas (wildlife).
Ecology	The Normal Plant Heat Sink (NHS) that will be used to dissipate heat from the turbine cycle for the new facility will utilize cooling towers to dissipate the heat directly to the atmosphere.
Ecology	The heat dissipation system for the NHS for the new facility will use either natural draft cooling towers or linear mechanical draft cooling towers.
Ecology	Two types of cooling systems will be considered for a new facility at the Grand Gulf ESP site: natural draft cooling towers and mechanical draft cooling towers.
Ecology	Environmental measurements and monitoring of terrestrial and aquatic ecology at the GGNS site will be divided into four phases: • Pre-application (CP or COL) Monitoring • Site Preparation and Construction Monitoring • Pre-operational Monitoring • Operational Monitoring
Ecology	The Grand Gulf ESP site will not be substantially different from the acceptable environmental impacts identified for the previously analyzed sites.
Ecology	(Coal) Additional ecological impact will occur due to land use related to mining of coal and limestone. Substantially greater impacts expected, relative to that required for uranium mining and reprocessing.
Ecology	(Combined Cycle Natural Gas) Additional ecological impact will occur due to land use related to gas wells and collection stations; expected to be proportionally higher than that related to uranium mining and reprocessing.
Water Use and Quality	Plant makeup (cooling tower makeup and other raw water needs) for a new facility would be supplied from the Mississippi River via an intake structure located on the east bank of the river.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Water Use and Quality	Emergency cooling water (ultimate heat sink) for a new facility would be provided from closed-cooling systems which utilizes enclosed basins with mechanical draft cooling towers, or similar heat removal mechanisms, and would not be reliant on the source of water from the river intake, with the possible exception of normal make-up.
Socioeconomics	Emergency planning responsibilities are assigned to a number of departments and agencies. Federal, state and local officials will implement appropriate protective actions in case of an emergency.
Socioeconomics	A highway construction plan to extend the present path of Highway 18 is in the early planning stages. This proposed extension will connect Highway 18 to Grand Gulf Road, providing additional access to the GGNS site.
Socioeconomics	Depending on the type of plant (merchant plant which would be unregulated, or a regulated – by the Public Service Commissions of Mississippi and Louisiana plant), the tax structure may be similar to the GGNS Unit 1 (for a regulated plant), or be some mutually agreeable amount for an unregulated merchant plant.
Socioeconomics	The actual mode of shipment [of irradiated fuel] will be determined by DOE and may include either rail or truck shipments.
Socioeconomics	Construction of the cooling towers will have minimal impact on the surroundings. Construction noise levels during construction of a new facility at the Grand Gulf ESP site will have minimal impacts on the surrounding populace.
Socioeconomics	Complying with applicable OSHA noise regulations will ensure that the impact on construction workers is considered to be small.
Socioeconomics	A construction noise abatement and protection program will provide required mitigative measures for noise which may, on a short term basis, exceed guidance [65dB(A)]. Excessively loud construction activities would be done during daylight hours if necessary.
Socioeconomics	Traffic on Grand Gulf Road will increase substantially during the peak construction period, and will be at its peak during the morning and evening shift changes. Noise in the general area will increase from this increased traffic but the increases will be temporary, and will only occur as indicated twice per day, during the week.
Socioeconomics	Many of the short-term employees will likely travel to the area unaccompanied by family members.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Socioeconomics	Rural setting of the site and the premise that the majority of the work force will emanate from the surrounding more populated areas and communities away from the site, it is likely a large portion of these new business and jobs would be temporary.
Socioeconomics	U.S. 61 S is two-lane improved roadway - will be 4-lane, divided freeway within 2 years like U.S. 61 N from Port Gibson
Socioeconomics	SACTI model predicts that the majority of the fogging due to the operation of the LMDCTs will be confined to within about ½ mile (800 m) to the south to southeast of the towers with occasional fogging (approximately 2 hrs/yr) up to about ¾ mile (1200 m) to occasional fogging (approximately 2 hrs/yr) up to about ¾ mile (1200 m) to the south to southeast of the towers (this area is entirely within the property boundary of the site). Therefore, it is predicted that the operation of the LMDCTs will result in limited increased fogging at the site.
Socioeconomics	While the proposed project's workforce and construction time period are greater than that of the gas plant, the impacts will be short term and mitigated by dispersion over several relatively populous counties and improved transportation routes.
Socioeconomics	Facility workforce will add to road network traffic load with an associated increase in traffic accidents. Road improvements and flexible work schedules will mitigate this impact to a certain extent.
Socioeconomics	Several road improvement and construction projects have been accomplished or planned for GGNS area. These projects will help ameliorate traffic problems associated with the proposed new facility.
Human Health	Liquid radwaste system design will be such that water which is discharged to the environment shall result in radioactive releases which conform to the "as low as reasonably achievable" requirements of 10 CFR 50.34a.
Human Health	Gaseous radwaste system design, including ventilation systems exhaust systems, will be such that radioactive gases which are discharged to the environment from these systems shall result in radioactive releases which conform to the "as low as reasonably achievable" requirements of 10 CFR 50.34a.
Human Health	The LWR technologies being considered will solidify and package their radioactive waste.
Human Health	In all likelihood, the decay time will be at least ten years and probably even longer.

Table J-1. (contd)

Technical Area	Environmental Report or RAI Statement
Human Health	The actual mode of shipment of spent fuel will be determined by DOE and may include either rail or truck shipments.
Human Health	The gas-cooled technologies being considered will solidify and package their radioactive waste.
Human Health	The gas-cooled reactor technologies will make far fewer shipments. The GT-MHR will need only 6 shipments while the PBMR will require 9 shipments annually.
Human Health	In the case of decay heat, both of the gas-cooled reactor technologies will generate fewer watts per MTU at time of shipment, and fewer kW per truck cask at time of shipment. The fuel inventory will be discussed as part of the remaining two characteristics that were exceeded: actinide inventory and krypton-85 inventory.
Human Health	Location of a new facility will be several hundred feet or more away from the protected area boundary, and about 1000 feet from the Unit 1 Turbine Building, the radiation levels due to nitrogen-16 skyshine are expected to be essentially background levels, similar skyshine are expected to be essentially background levels, similar to those readings obtained at TLDs located on the west/northwest side of the plant protected area boundary.
Human Health	These areas are several hundred feet from the protected area boundary, which will result in a substantial reduction in the dose rate due to distance from the source of the radiation.
Human Health	It is expected that the dose rates in these two constructions areas will be at or very near background levels.
Human Health	The doses they receive from background radiation will be more significant than nitrogen-16 skyshine doses.
Human Health	Implementation of a radiation environmental monitoring program for the new facility, compliance with requirements for maintaining dose ALARA, and attention to design of plant shielding to ensure dose is ALARA, will result in doses to the public and to construction workers due to direct radiation being minimal.

Table J-2. Key Assumptions Used by the NRC Staff in Assessing Environmental Impacts at the Grand Gulf Early Site Permit Site

Technical Area	Assumption	EIS Section
Land Use	The Grand Gulf ESP site will be wholly contained within the Grand Gulf site.	5.1
Land Use	The construction footprint will align with environmental report Figure 2.1-2.	5.1.1
Land Use	Land-use impacts of any potential transmission line right-of-way upgrade or expansion request will be assessed by the appropriate authority. State or local agency citing procedures will be followed once right-of-way routing is determined.	5.1.2
Land Use	Existing transmission line rights-of-way are 61 m (200 ft) in width.	5.1.2
Land Use	Transmission line upgrades would utilize only existing 500-kV transmission lines and rights-of-way. The 115-kV line is used to supply power to the site from offsite.	5.1.2
Land Use	No significant agriculture, crops, or dairy production are or will be located at or immediately near the Grand Gulf site.	5.1.1
Land Use	No third-party mining activities would be possible at the ESP site.	5.1.1
Land Use	Planned maintenance and refueling outages would be staggered such that only the GGNS Unit 1 or the proposed Grand Gulf ESP facility would be in outage at one time.	5.1.1
Land Use	Salt drift from any cooling tower design would be localized and well below NRC guidance thresholds.	5.1.1
Land Use	Induced housing effects of construction and operations would be dispersed across urbanized areas of southwestern and central Mississippi.	5.1.1
Land Use	The applicant would follow best management practices and would abide by all relevant regulations pertaining to ground-disturbing activities, such as forest and wetlands protection.	5.1.1, 5.1.2

Table J-2. (contd)

Technical Area	Assumption	EIS Section
Meteorology and Air Quality	Meteorological data from the site presented in various tables in the environmental report and request for additional information responses are reasonably representative of the site (except for wind data). Only the wind data for 2001 to 2003 are assumed to be representative.	2.3.3
Meteorology and Air Quality	Air emissions from the Grand Gulf ESP facility would be bounded by those listed in the environmental report .	5.2.2
Meteorology and Air Quality	The applicant would use dust control measures during construction and operation.	4.2.1
Meteorology and Air Quality	If air quality impacts related to transportation occur during construction, the applicant would implement best management practices to minimize the impacts.	4.2.2
Meteorology and Air Quality	Various measures outlined in the environmental report would be followed to limit air quality impacts of construction.	4.2.1
Meteorology and Air Quality	Cooling towers would have drift eliminators that are comparable in effectiveness to the drift eliminators in current generation cooling towers.	5.2.1
Ecology	Upland and bottomland areas of the proposed Grand Gulf ESP site that would be disturbed by construction would undergo a botanical survey prior to initiating such activities.	4.4.1.4
Ecology	A recent description will be provided of the aquatic biota that are in the vicinity of the ESP site and the transmission line rights-of-way prior to or during the CP or COL stage. The description will be consistent with NUREG 1555, Environmental Standard Review Plan, Chapter 2.4.2.	4.4.2, 4.4.3,1, 5.4.2, 5.4.3.1, 7.4
Ecology	The proposed intake system will have screens with a size such that the average intake velocity through the screen would be less than or equal to 0.15 m/s (0.5 ft/s).	5.4.2.1

Table J-2. (contd)

Technical Area	Assumption	EIS Section
Socioeconomics	Per the discussion in the environmental report, the staff assumed that 50 percent of the workforce at the Grand Gulf ESP site would come from the 80-km zone surrounding the plant, with almost all immigrating personnel and families living in Vicksburg, suburban Jackson, and Natchez. The staff also did the impact analysis under the alternative assumption that personnel and families would be distributed the same as the current plant-related population for GGNS.	4.5.2, 4.5.3.1, 4.5.4.3, 4.5.4.4, 5.5.2, 5.5.3.1, 5.5.4.1, 5.5.4.3, 5.5.4.4, 5.5.4.5
Socioeconomics	For the Grand Gulf ESP site, the staff identified two ways in which a new nuclear plant might be treated for property tax purposes under Mississippi tax law, which was assumed to remain the same in the future. If the plant were a merchant plant, it might be taxed as an ordinary taxable business asset, taxable by Claiborne County. The other possibility is that the state of Mississippi might decide to tax the asset instead, and provide some share of the funds back to the county and to the city of Port Gibson. The staff did the analysis both ways.	4.5.3.2, 5.5.3.2, 2.8.2.3
Socioeconomics	The staff relied on SERI’s statement in a reply to a request for additional information that it had no plans to restore the former rail spur to the Grand Gulf ESP site. This implies that large items and bulk materials would come in by barge or truck. SERI also said that a rail spur could not be precluded.	2.2.1, 2.8.2.2, 4.5.4.1
Socioeconomics	The staff assumed that if very large groups of families with school-age children moved into Claiborne County, the state of Mississippi would provide some impact assistance to the local school system.	4.5.4.5, 5.5.4.5
Environmental Justice	There are no unidentified and significant pre-existing health conditions or resource dependencies among minority and low-income populations in the region of the Grand Gulf ESP site.	4.7, 5.7
Environmental Justice	The relative geographical locations of concentrations of minority and low-income individuals in the region of the Grand Gulf ESP site as shown in the 2000 U.S. Census are valid at time of CP or COL application.	4.7, 5.7

Table J-2. (contd)

Technical Area	Assumption	EIS Section
Cultural Resources	Cultural resource surveys will be conducted if areas identified in Figure 4-1 in the EIS are selected for construction.	4.6
Cultural Resources	Appropriate cultural resource surveys would be conducted prior to construction of new transmission lines.	4.6
Cultural Resources	Cultural resource-specific written directions will be included in SERI's Excavation and Backfill Work Procedures prior to construction and operation.	4.6, 5.6
Human Health	New transmission lines would be built to current industry and regulatory standards.	5.8.3
Human Health	Appropriate State and local requirements would be considered when assessing the occupational hazard and health risks associated with construction.	4.8.1
Human Health	The staff assumed adherence to NRC, Occupational Safety and Health Administration, and State safety standards, practices, and procedures for operation of new nuclear units.	5.8.5
Human Health	New unit or units are constructed at the location identified in the ER.	4.9
Human Health	Assumptions listed on pages 6-41 and 6-42.	6.2.4
Accidents	Population growth in the vicinity of the site would not alter the population distribution in the region.	5.10.2

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10. SUPPLEMENTARY NOTES

Docket Number 52-009

11. ABSTRACT *(200 words or less)*

This environmental impact statement (EIS) has been prepared in response to an application submitted to the NRC by System Energy Resources, Inc. (SERI) for an early site permit (ESP) for the Grand Gulf ESP site located adjacent to the Grand Gulf Nuclear Generating Station, Unit 1, in Claiborne County, Mississippi. The ESP would not authorize construction or operation of a nuclear power plant.

The staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the ESP should be issued. This recommendation is based on (1) the application, including the environmental report (ER) submitted by SERI; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the scoping process and on the draft EIS; (5) the assessments summarized in this EIS; and (6) the staff's conclusion in this EIS that there are no environmentally preferable or obviously superior alternative sites.

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